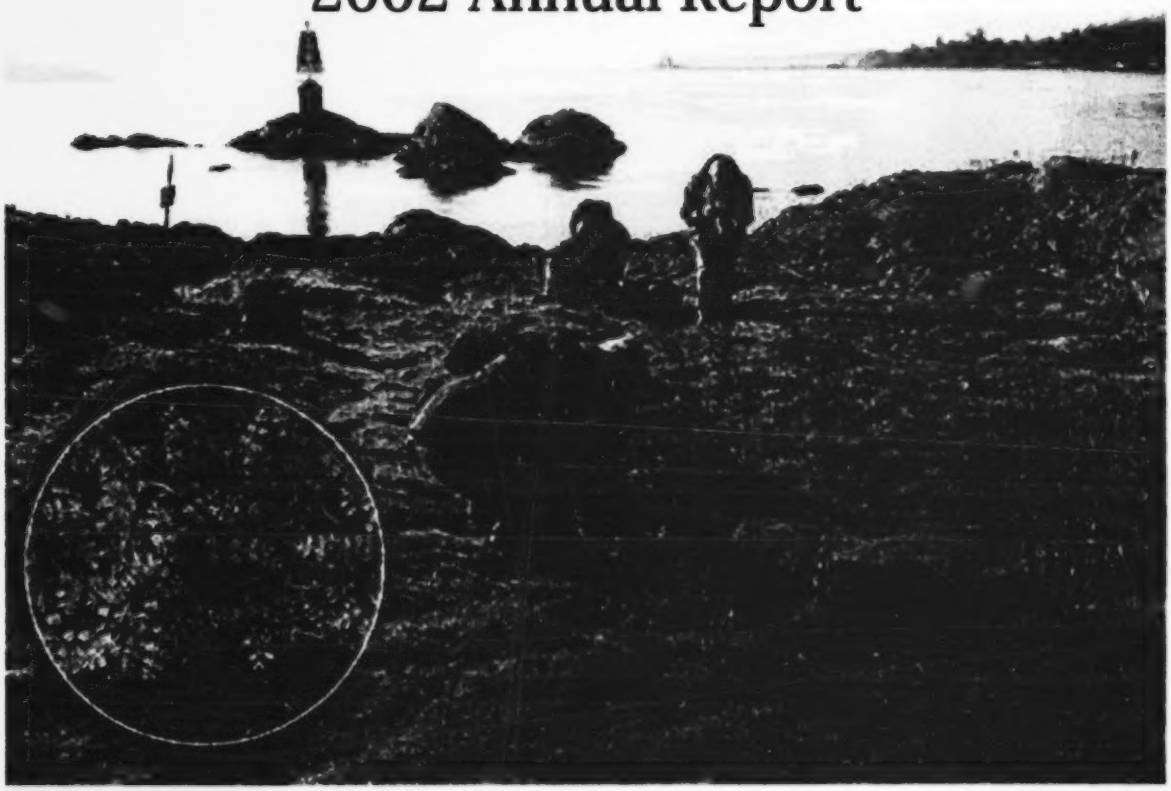
DEPARTMENT OF NATIONAL DEFENCE

ESAC

ENVIRONMENTAL SCIENCE ADVISORY COMMITTEE

CANADIAN FORCES BASE ESQUIMALT

2002 Annual Report



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Prepared by:

Stephanie Blouin
Department of National Defence
MARPAC, CFB Esquimalt
Formation Risk Management Branch
P.O. Box 17000 Station Forces
Bldg 199 Dockyard
Victoria, BC V9A 7N2

Nicole Ayotte
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5

Reviewed by:

Arthur Robinson
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5

Dr. Tony Trofymow
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5

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S. Blouin - Rocky Point Bird Observatory

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A. Ceska - Surveying for Macoun's meadowfoam (*Limnanthes macounii)* at Inskip Island • CFB Esquimalt

Inset:
S. Blouin - Macoun's meadowfoam (*Limnanthes macounii)*

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EXECUTIVE SUMMARY

This Annual Report provides a summary of the research activities conducted during 2002 under the Department of National Defence (DND) Environmental Science Advisory Committee for Canadian Forces Base (CFB) Esquimalt properties. The Environmental Science Advisory Committee (ESAC), established in 1994, is as a multi-agency technical advisory committee that reviews, tracks and issues permits for research proposals to conduct research on CFB Esquimalt properties. ESAC collects, archives, and reports the results of environmental research activities and also acts as an advisory body to CFB Esquimalt on environmental issues occurring on CFB Esquimalt properties.

A five-year regional Memorandum of Understanding (MOU) (2001-2006) was signed between CFB Esquimalt and the Canadian Forest Service (CFS) to reaffirm the level of commitment between the two participants to deliver and manage a new Natural Resources Program, which replaced the DND/CFS Forest Resources Management Program. Consequently, ESAC recommendations and reporting activities are now made to the Steering Committee of the Natural Resources Program for CFB Esquimalt properties.

In 2002, the Committee reviewed 21 proposals and issued 20 permits, of which seven were renewals of previous permits. Examples of projects conducted this year range from a study on the thermal characteristics of Townsend's Big-eared Bat roosts at Mary Hill to Garry oak acorn surveys at CFMETR, to a pilot monitoring program for terrestrial salamanders at Rocky Point and Royal Roads, and so on.

DND sponsors numerous environmental projects conducted on CFB Esquimalt properties and for the first time, summaries of these projects are included in the ESAC Annual Report. Examples of research projects include an investigation of site usage and disturbance of a Double-crested Cormorant (*Phalacrocorax auritus*) winter roost site at Rocky Point, a deer habitat study in Dockyard, and surveys for terrestrial and freshwater molluscs on DND lands near Victoria, B.C.

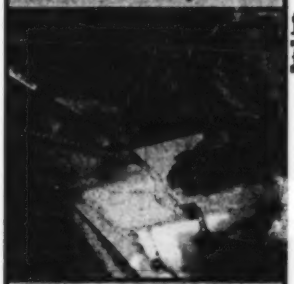
Existing natural resource layers in the CFB Esquimalt Natural Resources Geographic Information System (GIS) Database were updated throughout 2002 to include information collected by researchers.

To facilitate the sharing of this information, the Committee hosted the 2002 Annual ESAC Workshop, in January 2003 at the Pacific Forestry Centre, in Victoria B.C. It was the largest turnout to date.

This year, the ESAC website, hosted by the Canadian Forest Service, has been given a new look. Please visit our website at: www.pfc.cfs.nrcan.gc.ca/programs/esac

Black-tailed Deer
DND - Sponsored Project:
Deer Habitat Study

Northern Saw-whet Owl
Permit P082-02:
Small Owl Project



Western Red-backed Salamander
Permit P083-02: Pilot Monitoring
Program for Terrestrial Salamanders

Garry oak wildflower - Common camas (Camassia quamash)

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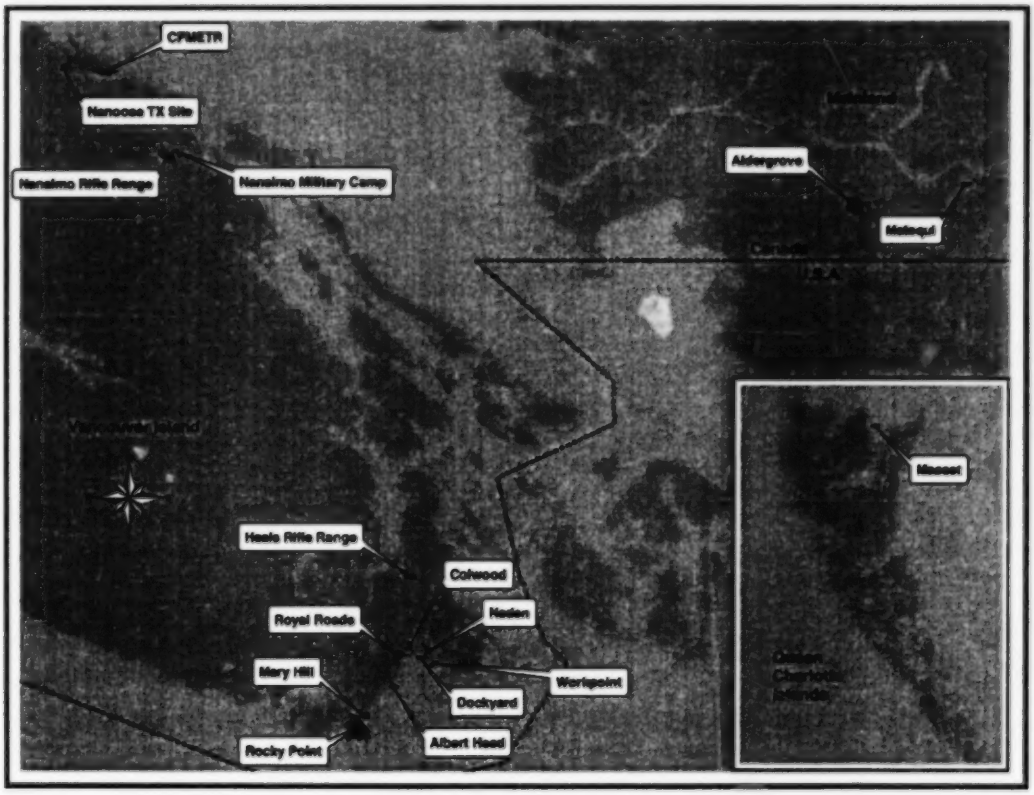
CFB ESQUIMALT PROPERTIES

Table 1: CFB ESQUIMALT PROPERTIES - Total Area in hectares (ha)

Albert Head	92.7	Matsqui	95.1
Aldergrove	514.0	Naden	45.4
Colwood	90.0	Nanaimo Military Camp	85.0
CFMETR / Nanoose Bay	288.4	Nanaimo Rifle Range	351.0
Dockyard / Signal Hill / Yarrows	62.7	Nanoose TX Site	105.0
Heals Rifle Range	212.4	Rocky Point	1078.0
Mary Hill	178.1	Royal Roads	229.0
Masset, Queen Charlotte Islands	824.0	Work Point	66.0
TOTAL AREA: 4,316.7 ha			



BACKGROUND

HISTORY

CFB Esquimalt administers over 4,300 hectares of land on 16 different properties (Table 1), of which over 3,200 hectares are forested. As human disturbance is minimal within these areas, they have become a refuge for many species of plants and animals. A number of the properties support rare species and remnants of threatened ecosystems such as Coastal Douglas-fir forests and Garry oak meadows, providing unique opportunities to conduct a variety of environmental research. For many years, various individuals and organizations have carried out research on CFB Esquimalt properties however most of this research was ad hoc and uncoordinated.

The absence of a process for tracking the research activities and associated findings resulted in the creation of the Department of National Defence (DND) Environmental Science Advisory Committee – CFB Esquimalt, commonly known as ESAC, in 1994. Original ESAC members included CFB Esquimalt, Canadian Forest Service, Canadian Wildlife Service, B.C. Ministry of Forests, University of Victoria, Royal Roads University and Lester B. Pearson College of the Pacific. In 1998, Lester B. Pearson College of the Pacific withdrew as a member agency of the Committee.

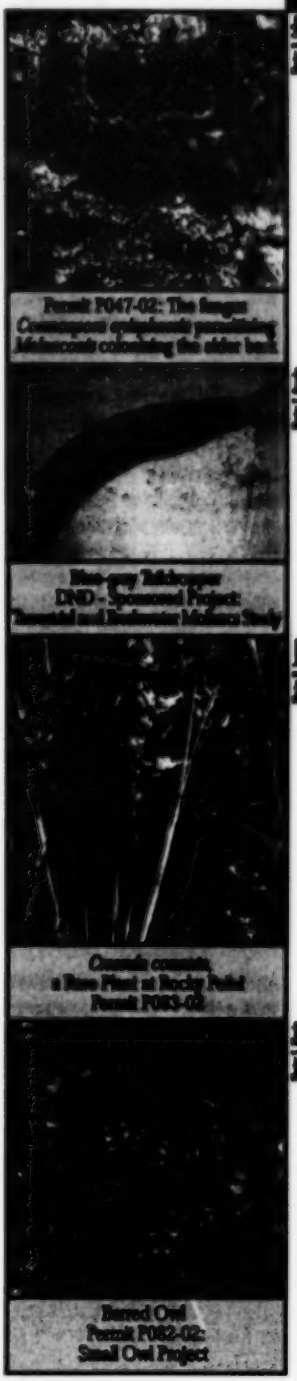
In 2001, CFB Esquimalt and the Canadian Forest Service signed a Memorandum of Understanding (MOU) to solidify a level of commitment between the two parties to create, deliver, and manage a joint Natural Resources Program for a five-year time frame (2001-2006). As a result, ESAC recommendations and reporting activities are now made to the Steering Committee of the CFB Esquimalt Natural Resources Program.

MEMBERS

The Environmental Science Advisory Committee (ESAC) is a multi-agency committee composed of representatives from the following member agencies:

- CFB Esquimalt
- Canadian Forest Service
- Canadian Wildlife Service
- B.C. Ministry of Forests
- University of Victoria
- Royal Roads University

A complete list of ESAC members and contact information is located at the end of this report.



BACKGROUND

ROLES AND RESPONSIBILITIES

The Committee's primary functions are to review, evaluate, and provide expertise and advice to CFB Esquimalt on proposals received to conduct biological inventories and research on CFB Esquimalt properties. The Committee sets up a formal permitting system to facilitate the tracking of proposals and permits to do research on CFB Esquimalt properties. In addition, ESAC is responsible for collecting and archiving reports obtained from permittees, making them available to member agencies and other interested agencies.

Scientific expertise existing within the Committee is available to CFB Esquimalt. The Committee acts as an advisory body, which provides direction and insight on numerous environmental issues occurring on CFB Esquimalt properties.

PERMITTING PROCESS

Studies contributing to the knowledge and understanding of the functioning of ecosystems and environmental management is greatly encouraged on CFB Esquimalt properties. To facilitate the tracking of these activities, the Committee has developed and implemented a formal permitting process. Natural science activities within CFB Esquimalt properties requiring a permit include, but may not be limited to the following:

- observations, filming, photography;
- surveys and inventories;
- tagging and banding;
- collection of flora, fauna, and geological specimens;
- intrusive surveys and research involving physical disturbance of the land; and
- installation of scientific monitoring instruments and structures.

Individuals must apply through the Committee to conduct research on CFB Esquimalt properties. The application process involves submitting a completed application form to the Committee at least one month prior to the planned commencement of the project. The application form can be obtained on the ESAC website or by contacting the Committee. The Committee then reviews and evaluates each proposal and if acceptable, recommends it for approval by DND. Permits are issued on an annual basis and expire December 31st of that year. Permits may also be issued for long-term projects but must be renewed annually.

The Committee has revised the ESAC permit application form and the application process has been adjusted in efforts to make the permitting process more efficient. The application process can now be performed through email.

REPORTING ACTIVITIES

As part of the reporting process, permittees are required to submit a report of the work conducted throughout the year. These reports are compiled and published in the ESAC Annual Report. All ESAC Annual Reports from 1995 to 2002 are available on the ESAC website.

To facilitate the sharing of information of research conducted on CFB Esquimalt properties to other researchers and interested agencies, the Committee hosts an annual workshop. The workshop allows permittees to present a summary of the work they have conducted throughout the year. In addition, the workshop provides an opportunity for CFB Esquimalt to present other environmental initiatives they have undertaken throughout the year. Information on the workshop can be obtained through the Annual Report, on the ESAC website, or by simply contacting the Committee.

ESAC ACTIVITIES IN 2002

RESEARCH & COLLECTION ACTIVITIES

This year was the eighth full year of activity for ESAC. The Committee met four times during 2002 to review and track the status of the various proposals that were received. A total of 21 proposals were received and 20 permits were issued, of which seven were renewals of previous permits. Table 2 shows the number of proposals received and permits issued annually, since 1995.

The title and permit number of each approved proposal are listed in Table 3. Annual progress reports and final reports submitted by each of the permittees in 2002 can be found in the section entitled: *Research and Collection Activities Conducted in 2002 under the auspices of ESAC.*

Table 2: Number of ESAC proposals and permits since 1995

Year	# of proposals	# of permits
2002	21	20
2001	14	14
2000	19	16
1999	25	25
1998	26	26
1997	24	24
1996	25	24
1995	22	20

A member of the Bald Eagle Nest Tree (BENT) Monitoring Program observes a bald eagle nest at Rocky Point
Permit: P074-02: Wildlife Tree Stewardship Initiative

RESEARCH & COLLECTION ACTIVITIES

Table 3: List of issued permits

Prop	Permit	Contact	Title	Property
02-01	P080-02	Bennett	Survey of Rare and Endangered Plants and Invertebrates in Garry Oak and Associated Ecosystems on Southern Vancouver Island	AH, MH, CFMETR NRR, RP, NAD, WKP, DKY
02-02	P081-02	Matthews	Pearson College Field Study	MH
02-03	P064-02	Gillis	Geological Survey of Metchosin Complex	RP
02-04	P046-02*	Mogensen	Natural History Survey and Related Mapping of Royal Roads	RR
02-05	P082-02	Doyle	Small Owl Project	NTX
02-06	P003-02*	Allinson	Bird Migration Monitoring	RP
02-07	P074-02*	Greenwood	Wildlife Tree Stewardship Program	RP
02-08	P083-02	Janszen	*Crassula connata* Site Location	RP
02-09	P050-02	Ceska	Monitoring *Limnanthes macounii* and other Rare Vascular Plants	AH, CFMETR, MH, RP
02-10	P084-02	Hallstrom	Effect of Habitat Loss and Invasion by Scotch Broom on Rare Butterflies of Garry Oak Meadows	NTX, RP
02-11	P044-02*	Finlay	Purple Martin Origins and Relationships	COL
02-12	P047-02*	Callan	Measurement of Fungal Biodiversity on Cut Alder Logs	RP
02-13	P031-02	Otvos	Monitoring Winter Moth and the Parasites Introduced for its Control	DKY
02-14	P075-02*	Humphrey	Environmental Technology Program Field Trip	RP
02-15	P086-02	Craig	Thermal Characteristics of Townsend's Big-Eared Bat Roosts	MH
02-16	P087-02	Dushenko	Microclimate Station Upgrading	RP
02-17	P041-02*	Hebda	Advanced Field Methods of Restoration Course	RR
02-18	P079-02	Courtin	Oregon White Oak Acorn Production Study	CFMETR, MH, RP
02-19	P088-02	Paige	Pilot Monitoring Program for Terrestrial Salamanders	RR, RP
02-20	P085-02	Dushenko	Ecological Monitoring and Assessment Network (EMAN) Plot Surveys	RR, RP

** Renewed from previous years*

Properties: AH: Albert Head; CFMETR: Canadian Forces Maritime Experimental and Test Ranges; COL: Colwood; DKY: Dockyard; MH: Mary Hill; NAD: Naden; NRR: Nanaimo Rifle Range; NTX: Nanoose TX Site; RP: Rocky Point; RR: Royal Roads; WKP: Work Point.

OTHER COMMITTEE ACTIVITIES

As a follow-up to a 2002 suggestion from Lester B. Pearson College for enhanced protection of an area used by Double-crested Cormorants as a winter roost site along Pedder Bay, CFB Esquimalt initiated a study to investigate the use of the site and the levels of and causes of roost disturbance. A summary of the study is presented in the final section of this report.

To promote ESAC and its activities, a presentation panel outlining ESAC members, purpose and activities was produced. The panel is available for display at universities and environmental events.

An annual safety inspection was conducted in July 2002 on the Forest Canopy Research Station. Required maintenance is scheduled for late 2003.

Old Growth Douglas-fir Forest - Permit P075-02: Environmental Technology Program Field Trip

FOREST CANOPY RESEARCH STATION

Background

The Forest Canopy Research Station consists of five old growth trees that have been fitted with platforms in the canopy along with ladders leading to higher levels. A boardwalk made of "Superwood" (recycled plastic bags) provides a connecting pathway between the five trees on the ground. Tree 5 is located along the site access road and is isolated from the other four trees by approximately 75 metres. Trees 1, 2, 3, and 4 are situated in close proximity to each other along the southern edge of a one hectare EMAN (Ecological Monitoring and Assessment Network) forest plot and are connected by "Burma" rope bridges.

Access to the canopy of Tree 1 (which supports a microclimate station) is by means of a boson chair and a hand-operated winch attached to a nearby smaller tree. The person in the boson chair is winched up to the platform. From there, access to the upper part of the tree is by ladders attached to the trunk. A rope bridge connects lower platforms between Tree 1 and 2. Access to the canopy of Tree 4 is also by means of a winch that hauls the person up to the platform of Tree 4. From this platform, access to the other two trees is by means of rope bridges. Another rope bridge connects Tree 4 to an additional large tree approximately 25 metres away. Since 1998, the University of Victoria has assumed responsibility for the microclimate station facility. The Forest Canopy Research Station Operating Committee (FCRSOC) is committed to increasing the use of the facility through more active promotion to the scientific community.

Current Activities

The operation and maintenance of the Forest Canopy Research Station was handed over to Royal Roads University in 2002. This has become part of the university's efforts to monitor climate change and atmospheric transport of contaminant chemicals. As of the end of 2002, all sensors associated with the microclimate station were removed, tested and recalibrated, and a new environmental sensing strategy for the site has been developed. An aerial ladder has been installed between Trees 1 and 2 to support temperature/relative humidity (RH) profiling within the canopy.

Future Activities

Plans for 2003 include the installation of a solar panel supported by a 60 ft. tower on the rocky knoll adjacent to the microclimate station. This will provide a more permanent power supply to the data logger and sensors. A small utility shed will also be set up on the ground platform by Tree 1 to house the data logger and associated supplies. The canopy station equipment and platform system will also be modified and updated for easier accessibility.

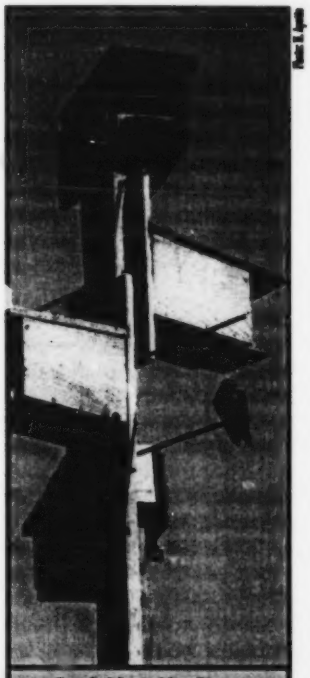
Forest Canopy Research Station - Rocky Point

GEOGRAPHIC INFORMATION SYSTEM

Over the last eight years, DND, the Canadian Forest Service (CFS), the Canadian Wildlife Service (CWS), and other agencies have collaborated extensively through ESAC in the delivery of environmental programs on CFB Esquimalt properties, particularly on southern Vancouver Island. During that period a great deal of information has been gathered to assess the ecological character of these lands. Findings from permitted research projects are also used to update information on the Base's Natural Resources Geographic Information System (GIS) Database.

In January 1997, a GIS project funded by DND was initiated to compile and convert the existing spatial data. The initial phases of the project were completed with the preliminary compilation and conversion of all the identified baseline data into a common ArcInfo format. Presently, all data are currently stored as ArcView shapefiles at CFS. This data and maps are used to guide military activities and development on the natural areas of the properties.

In late spring 2002, CFB Esquimalt provided funding to update the Natural Resources GIS Database. Thematic layers in the GIS database (i.e. baseline, archaeological, and species data) were updated and a new Terrestrial Ecosystem Mapping (TEM) layer was added to the database for the following properties – Albert Head, Aldergrove, CFMETR, Colwood, Dockyard, Heals Rifle Range, Mary Hill, Masset, Matsqui, Naden, Nanaimo Rifle Range and Rocky Point. Additional layers, such as significant and heritage tree data as well as ecosystems data were added to the Royal Roads property. A total of 66 map sheets were upgraded to ArcView8 and formatted to provide printable coverages of the 16 properties. A CD-ROM containing the data updates was distributed to member agencies.



Purple Martin Nest Boxes
Permit P044-02:
Purple Martin Origins
and Relationships

Table 4: Status of CFB Esquimalt Natural Resources Program GIS Database

		AH	ALD	CFMETR	COL	DKY	HRR	MH	MASS	MATS	NAD	NMC	NRR	NTX	RP	RR	WKP
File Type	DXF Files										1983		1983				
	ArcView Shapefiles	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998		1998		1998	1998	1998
GIS Layers - Date of Last Update	Contours	1983	1983	1983	1986	1983	1983	1983	1983	1986	1983	1983	1983	1983	1983	1986	
	Roads	2000	2000	2000	2000	1999	2000	2000	1983	1983	1999	1983	2000	1983	2001	2002	1999
	Water	2000	2000	2000	2001	1999	2000	2000	1983	2001	1999	1983	2000	1983	2001	1998	1998
	Man-made Structures	2002	2001	2000	2000	1999	2000	2000	1983	2001	1999	1983	2000	1983	2000	1998	1999
	Forest Cover	2001		2001	2001	2001	2001	2001	2001	2001	1983	1983	2000	2001	2001	2001	
	Cons. Mgmt Zones	1998		1998		n/a		1998			n/a				1998	1998	n/a
	Rare Species	2001	2000	2001	2001	1999	2001	2001		2002			1998		2002	1998	1999
	Birds	1998		1998	1998		1998	1998					1998		2000	1998	
	Archaeological Sites	2002		2001	2001	1998	2001	2001	2001	2001	1998		2001		2001	1998	1998
	Research Plots			1999				1998							2000		
	Contaminated Sites	1998		1998		1998					1998		1998		1998		
	TEM	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002		2002		2002		2002
	Ecosystems															2002	
	Significant & Heritage Trees															2002	

Properties: AH: Albert Head; ALD: Aldergrove; CFMETR: Canadian Forces Maritime Experimental and Test Ranges; COL: Colwood; DKY: Dockyard; HRR: Heals Rifle Range; MH: Mary Hill; MASS: Masset; MATS: Matsqui; NAD: Naden; NMC: Nanaimo Military Camp; NRR: Nanaimo Rifle Range; NTX: Nanoose TX Site; RP: Rocky Point; RR: Royal Roads; WKP: Work Point.

2002 ANNUAL ESAC WORKSHOP

The 2002 Annual ESAC Workshop for projects conducted in 2002 was held at the Pacific Forestry Centre on January 30th, 2003. The workshop provided an opportunity for permittees to present an overview of their findings. Eleven presentations were given to approximately 50 individuals; this was the largest annual workshop turnout to date.

ESAC WEBSITE

In 1999, the Committee undertook the development of a website to improve the availability of the work described in the ESAC Annual Reports. The website includes an introduction to the CFB Esquimalt properties and to ESAC explaining how the Committee developed the permitting process, and committee activities to date. Also included are links to member agencies allowing Internet users to check on the members' areas of expertise.

The website contains the complete text of all Annual Reports from 1995 - 2002. A consolidated list of all other reports and papers is also included.

In keeping with Government of Canada standards, the introductory section of the website is provided in both English and French. The website can be found on the Canadian Forest Service, Pacific Forestry Centre website at: www.pfc.cfs.nrcan.gc.ca/programs/esac

Assessing the impact of Black-tailed deer browsing on Common camas - Rocky Point

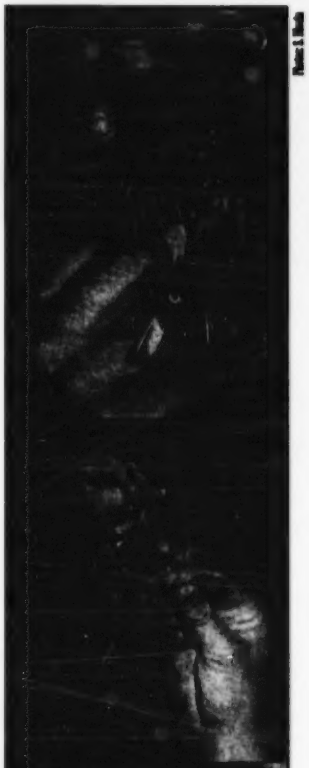
A SPECIAL HIGHLIGHT: The Rocky Point Bird Observatory (RPBO)

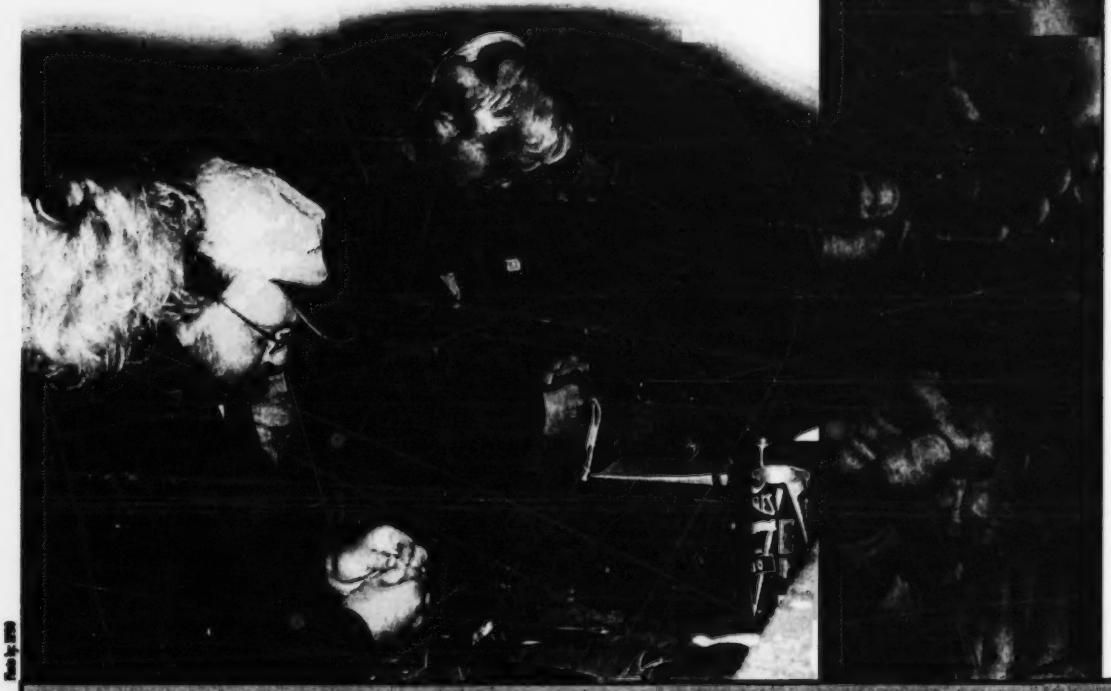
There are plenty of opportunities for long-term scientific activities on CFB Esquimalt properties. Since the creation of ESAC in 1994, numerous scientific studies have continued over multiple years with the most extensive study being that of the monitoring of neotropical migratory birds by the Rocky Point Bird Observatory (RPBO). With the original permit being issued in 1995, the RPBO has continued to conduct their work at Rocky Point, by renewing their ESAC permit on an annual basis.

The location of Rocky Point on the Strait of Juan de Fuca serves as a migratory stopover and staging area for many bird species and thus provides an ideal location for monitoring movements of migratory birds.

Established by the CWS in 1994 and part of the 21 member Canadian Migration Monitoring Network (CMMN), the RPBO plays an important role in monitoring migratory birds. The monitoring operation covers an area of approximately 9 km^2 and more than 21,400 birds, representing 90 different species have been banded since 1994.

For more information on the Rocky Point Bird Observatory, visit the following website: www.islandnet.com/~rpbo/



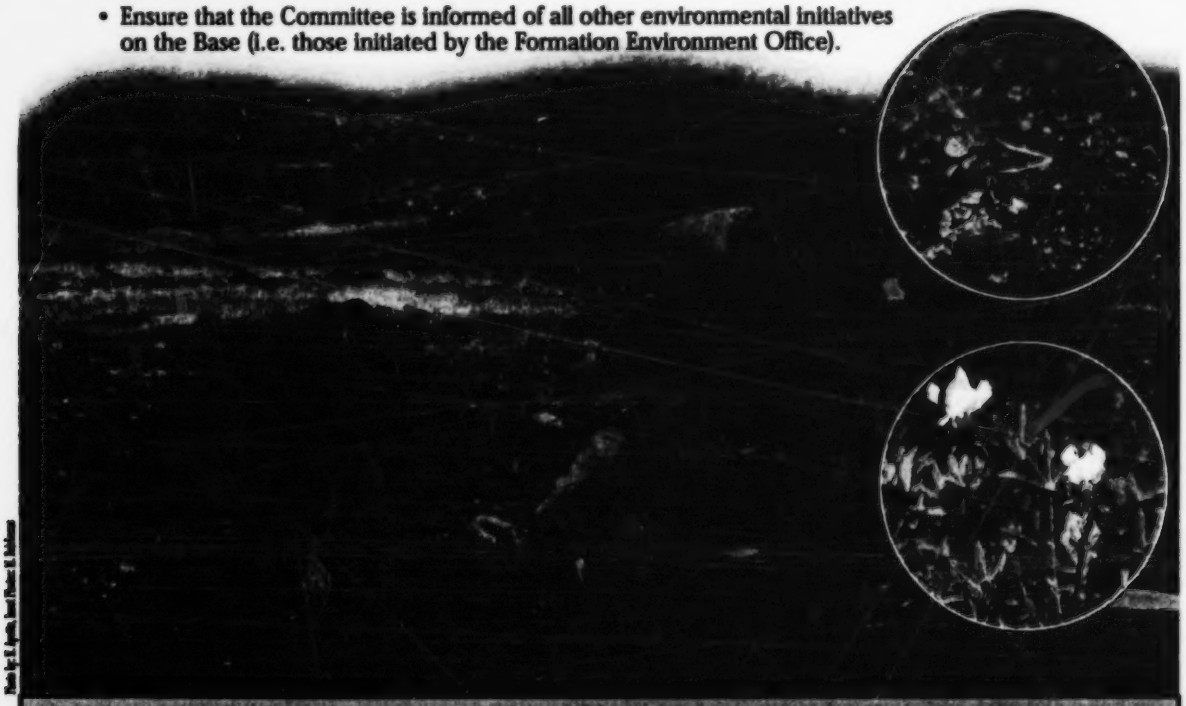


Rocky Point Bird Observatory - Permit PO03-02: Bird Migration Monitoring

OUTLOOK FOR 2003

The Committee plans to:

- Continue to review and track the status of various research projects on CFB Esquimalt properties, sponsor the Annual Workshop and assist with the preparation of the Annual Report;
- Update the website and facilitate the dissemination of information;
- Revise and update the ESAC Research and Collection Permit to meet the needs of DND;
- Develop an information brochure to promote the Committee and its activities. Distribute the brochure to other Canadian Forces Bases, provincial and other federal government departments, and academic institutions;
- Maintain and update the CFB Esquimalt Natural Resources GIS Database;
- Delineate locations of rare and endangered species and their critical habitat on CFB Esquimalt property maps, in response to the Species at Risk Act (SARA);
- Examine the management options outlined in the Double-crested Cormorant winter roost site study at Rocky Point and make recommendations to DND for further action;
- Restructure and maintain the Forest Canopy Research Station and continue to encourage its use to scientific communities; and
- Ensure that the Committee is informed of all other environmental initiatives on the Base (i.e. those initiated by the Formation Environment Office).



Rare plant surveys on CFB Esquimalt properties • Inset photos: Seaside Bird's-foot Trefoil and Dense-flowered Lupine

DEPARTMENT OF NATIONAL DEFENCE

ESAC

ENVIRONMENTAL SCIENCE ADVISORY COMMITTEE

CANADIAN FORCES BASE ESQUIMALT

REPORTS

Research and Collection Activities Conducted in 2002 Under the Auspices of ESAC

Survey of Rare & Endangered Plants and Invertebrates in Garry Oak and Associated Ecosystems on Southern Vancouver Island

Dr. Robert G. Bennett

B.C. Ministry of Forests, 7380 Puckle Road, Saanichton, BC V8M 1W4
Tel: (250) 652-6593 • Email: Robb.Bennett@gems6.gov.bc.ca

Permit No.: P080-02
Location: Albert Head, Mary Hill, CFMETR (South Ballenas & Winchelsea Islands), Nanaimo Rifle Range, Rocky Point, Naden, Work Point, Dockyard

Start Date: April 1, 2002
Completion Date: December 31, 2002

Project Overview

Under the terms of the Federal/Provincial Accord for the Protection of Species at Risk, the Province of British Columbia has agreed to participate in the processes of identifying and designating species at risk (those species designated as such federally by the Committee on the Status of Endangered Wildlife in Canada and/or provincially by the B.C. Conservation Data Centre (CDC)), protecting their habitats, and developing recovery plans for them. Crucial to meeting these obligations are habitat surveys to establish presence/absence inventories and generate distribution/abundance data for species at risk.

As part of British Columbia's efforts, inventories of species at risk are currently being conducted on public and private lands throughout the Province. It is a well-established fact that a large proportion of the Province's rare, threatened, and endangered species live in the Georgia Lowlands of southeastern Vancouver Island, the Gulf Islands, and adjacent areas of the Mainland. Of particular importance are Garry oak and associated ecosystems. The Department of National Defence is a major manager of such ecosystems. A provincial survey of species at risk in Garry oak ecosystems will necessarily be incomplete without data from DND properties.

This project seeks to provide a complete inventory and, when possible, distribution/abundance data of insect and plant species at risk in Garry oak and associated ecosystems in the Georgia Lowlands of B.C. These data will allow for accurate "at risk" designations and provide the basis for building effective recovery plans.

Objectives

Provide baseline presence/absence and distribution /abundance data for the accurate status assessment of federally (COSEWIC) and provincially (CDC Red and Blue lists) listed invertebrate and plant species at risk.

Accomplishments to Date

The Ministry of Water, Land & Air Protection terminated a large part of its Species at Risk Program before this work could be carried out. Consequently, no work was accomplished under the terms of this permit and the project is on-hold pending re-activation of appropriate parts of the Ministry's program.

Pearson College Field Study

Angus Mathews

Lester B. Pearson College of the Pacific, 650 Pearson College Drive, Victoria, BC V8S 2M5
Tel: (250) 391-2406 • Email: amathews@pearsoncollege.ca

Permit No.: P081-02
Location: Mary Hill

Start Date: January 1, 2002
Completion Date: December 31, 2002

Project Overview

The pristine forest area beside Pearson College Campus provides a unique study area for Pearson College students to be introduced to field study skills. In addition to performing course work, students will add to environmental data collections through data collected during the training exercises.

Objectives

1. To develop student skills in field study work;
2. To enhance environmental inventory data; and
3. To monitor long-term change in the study areas.

Accomplishments to Date

Due to time constraints on course work, no work was carried out on the DND property.

Geological Survey of Metchosin Complex

Dr. Kathryn Gillis

School of Earth and Ocean Sciences, University of Victoria, P.O. Box 3055, Victoria, BC V8W 3P6
Tel: (250) 472-4023 • Email: Kgillis@uvic.ca

Permit No.: P064-02
Location: Rocky Point

Start Date: January 1, 2002
Completion Date: December 31, 2002

Project Overview

The Metchosin Complex (MC) originated in a small ocean basin, approximately 55 million years ago. As a requirement for a thesis, a student wanted to examine the outcrops of MC in order to characterize the spatial distribution of an unusual rock type (epidosites) that formed when hot seawater interacts with basaltic rock.

Objectives

1. To examine geological exposures of the Metchosin Complex; and
2. To investigate how and why epidosites form.

Accomplishments to Date

Due to time constraints on the project, the student was unable to carry out the study and no work was carried out on the DND property.

Natural History Survey and Related Mapping of Royal Roads

Tony Embleton[1] and Norm Mogensen[2]

[1] Chair of the VNHS Green Spaces Project
Tel: (250) 595 - 6812 • Email: aembleton@shaw.ca
[2] Royal Roads Survey Coordinator
Tel: (250) 477-9114 • Email: mogensen@islandnet.com

Permit No: P046-02
Location: Royal Roads

Start Date: August 29, 2001
Completion Date: November 15, 2002

Project Overview

As with other DND properties, the Victoria Natural History Society's (VNHS) Green Spaces Project (GSP) carried out ecological inventorying of the Royal Roads property. This project was started in 2001 and completed in November of 2002. The entirety of Hatley Park Estate (a.k.a. Royal Roads), except for the developed Royal Roads University campus core, its parking lots and groomed lawns and ornamental gardens, was covered by this survey. The ecological features were surveyed and a report prepared. A map of the features surveyed was produced. The results will be made available to land use planners, other stakeholders and decision-makers.

Objectives

The objectives of the project are as follows:
1. Carry out a survey and ecological inventory of the Royal Roads property and identify lands containing important ecological features;
2. Identify and map as many as possible of the special natural and human impact features that exist;
3. Produce a map of all ecosystem polygons that could be found on the site; and
4. Provide an objective evaluation of it from a conservation perspective.

Accomplishments to Date

During the last 15 months, VNHS Green Spaces Project volunteers contributed about 1,135 hours to conduct a detailed survey of, and to map the ecological and other natural aspects of Royal Roads property.

The property was divided into nine separate, easily manageable blocks. The survey was conducted by way of a series of measured, consecutive parallel transects across each block. In the course of each transect, observed natural history values were recorded. Compasses, retractable measuring tapes, laser scopes, and a handheld GPS device were used to confirm precise feature locations.

Highlights of Inventory Findings

The site has three main ecological (and geological) zones: the older (old-growth) forest clad plateau above and to the south, west and north of the main built campus area; a much smaller bedrock outcrop zone in the southeast corner; and the large riparian seepage zone on a wide arc perimeter abutting Esquimalt Lagoon west of Cottonwood Creek. Within these general zones are a rich variety of geological, ecological and culturally modified sub-systems and conditions, worthy of interest, and many worthy of further study.

Where logging has taken place, most of it was done over 100 years ago, and the site is still richly endowed with true old-growth trees. Indeed of the largest coastal Douglas-fir measured on the site, seven would qualify among the top 11 largest diameter trees of that type in the Province. The forest and its understory, especially on the west side of the site are generally varied and healthy.

Riparian aspects of the site also vary from the merging fresh and salt (tide) water estuary conditions at the mouth of Cottonwood Creek, to the large seepage zone caused by the draining of the plateau that forms the upland part of this site, and extends far beyond. Even the seepage zone has considerable ecological and geological variety, resulting from occasional, erosion caused, land rises that allow enough soil aeration to support some non-riparian ecosystems. One of these is probably the last outpost of Sitka spruce on southeastern Vancouver Island.

Much of the interface between the plateau and the riparian seepage zone consists of what appears to be an actively, but slowly eroding, in-forest escarpment, seepage at the base of which carries the sediments away and causes further slippage. This is a condition that is unknown to us and may be rare. Two post ice-age kettles, caused by slow melting ice lenses, were found in excellent condition.

The site was found to be surprisingly rich and varied from an ecological standpoint. Also, many new archaeological features were found there. It is one of only three similarly sized diverse sites that touch the urban containment boundaries of Greater Victoria. As such, given the high ecological quality and both the containment and connectivity of this site with respect to other nearby green/blue spaces, it would make a fine "Stanley Park" type nature preserve, being easily accessible from the adjacent, planned major high density residential/commercial area in this part of Colwood.

Details of all GSP survey findings are contained on accompanying maps, feature lists and in the more detailed general report which was submitted to the Department of National Defence.

The GSP strongly recommends the preservation and at some locations, enhancement of all natural features on this site. It recommends that future campus development be concentrated only in already disturbed parts of the site.

Conclusions

The undeveloped parts of Hatley Park Estate (approximately 175 ha), are mainly comprised of older forest (never logged or has been regenerating for over 100 years) and contains substantial elements of true old-growth forest, including seven qualifying trees amoung the top 11 largest diameter Douglas-fir trees in this province. In general, these forests remain in surprisingly undisturbed and apparently healthy condition. From an ecological standpoint, they are diverse, interesting and provide habitat for a wide range of creatures, ranging up to deer and cougar at the top end of predator/prey pyramid.

The post glacial Colwood delta outwash plateau, upon which the upper part of the site rests, acts as a large aquifer steadily supplying a wide riparian (seepage) zone along the lower shoreline margins of the site on a year round basis. This by itself, is rich habitat, and also is likely vital as the fresh water supplier that helps maintain balance in the apparently rich ecological regime in Esquimalt Lagoon.

In our view Victorians (particularly residents of the Western Communities) are very fortunate that this rich natural legacy from our forested past, remains so intact and in such good condition, so close to what is becoming a major sector of this urban community.

Small Owl Project

Don Doyle

Ministry of Water, Land and Air Protection, 2080-A Labieux Road, Nanaimo, BC V9T 6J9
Tel: (250) 751-3219 • Email: don.doyle@gems7.bc.ca

Permit No.: P082-02
Location: Nanoose TX Site

Start Date: September 15, 2002
Completion Date: November 1, 2002

Project Overview

To develop sampling and trapping techniques for marking Northern Saw-whet owls *(Aegolius acadicus)*, Northern Pygmy owls *(Glaucidium gnoma)*, and Western Screech owls *(Otus kennicottii)* on Vancouver Island, in conjunction with the Campbell River Watershed Owl Survey project and the Rocky Point Bird Observatory.

Objectives

Mastering these techniques will aid in trapping and marking Northern Saw-whet owls on Vancouver Island for various projects. Trapping at this site may also prove to be useful in marking significant numbers of migratory owls, in conjunction with the Rocky Point Bird Observatory in Victoria, B.C. Little is known about the seasonal movements of these owls on Vancouver Island and banding data from two geographically separated areas may help to show migration patterns of these small secretive owls.

Highlights of Findings to Date

A total of six Northern Saw-whet owls were trapped, banded, measured, and released successfully. The use of mist nets in combination with an audio lure was a successful and uncomplicated way to attract and catch Northern Saw-whet owls. The handling time was limited to 15 minutes per bird, and in this time all pertinent data could be collected.

Research Activities

Given the success of this preliminary study, we will attempt to trap more consistently and intensively in the future. During each trapping session one mist net and audio lure were used. Attempts will also be made to increase the number of mist nets in operation by strategically placing them around the audio lure. It is thought that this will increase the number of owls caught on any given night, and therefore increase the sample size. For each owl trapped, a small feather sample (~1 cm) was collected from the tenth primary feather on the right wing. These samples will be used in the future for isotope-ratio testing, to determine the bird's place of fledging. Future trapping may also focus on fitting birds with radio-transmitters in an effort to document the seasonal movements of small owls on Vancouver Island.

Bird Migration Monitoring

David Allinson[1] and Wendy Easton[2]

[1] Rocky Point Bird Observatory Society, 3370 Passage Way, Victoria, BC V9C 4J6
Tel: (250) 480-9433 • Email: passerine@shaw.ca
[2] Landbird Assessment Biologist, Canadian Wildlife Service, 5421 Robertson Rd., RR1, Delta, BC V4K 3N2
Tel: (604) 940-4573 • Email: Wendy.easton@ec.gc.ca

Permit No.: P003-02
Location: Rocky Point

Start Date: March 3, 2002
Completion Date: December 31, 2002

Rocky Point Bird Observatory 2002 Season Highlights:

The year 2002 was an eventful one at the Rocky Point Bird Observatory (RPBO). Weather played a role in keeping migrant songbird numbers down during July and August. Clear skies and successive high-pressure systems allowed nocturnal migrants to continue south without need for stopover or refuelling. For example, in spite of all thirteen nets running daily this year, our capture rate was down to only 0.48 birds/net-hour, compared to 0.60 in the previous year (see Table 1). Nevertheless, a combination of thirteen nets, excellent coverage, and busy days from mid-September until end of season on October 21 added up to our highest banding tally ever - 3153 individual birds of 56 species (an average of about 36/day). An additional 212 owls were banded during a pilot project (see following paragraph). Some 19,242 birds have now been banded since operations began in August 1994 (see Table 2). Only three full days were lost to rain this year, for a total of 87 days of coverage by over forty volunteers. Thirteen species recorded new season highs, with Ruby-crowned Kinglet (a phenomenal 466), Pacific-slope Flycatcher (271), and Wilson's Warbler (231) coming out as the top three species banded (these three species alone represented ~30% of captures). Some remarkable regional rarities were also recorded in our nets. British Columbia's sixth record of Blue-gray Gnatcatcher was captured on August 6th, and a Northern Parula was banded on August 23rd, representing only the third record of this species for the Province. A total of ninety species have now been netted at RPBO. Four additional new birds for the site checklist were also recorded - Marbled Godwit, Cattle Egret, Rusty Blackbird, and Common Redpoll. The new Rocky Point checklist total stands at 279 species (for comparison, this represents more than 75% of the entire Victoria and southern Vancouver Island checklist). Of interest, a total of 194 species were recorded over the course of the year (eclipsing last year's high of 192).

This year also marked the start of a new pilot project to capture migrant Northern Saw-whet Owls. The project's objectives were to band owls on the weekends from mid-September through to the end of October. The project would not only determine the feasibility of owl banding at RPBO, but also give us direction as to when monitoring should start and end. The plan was to band from dusk to an hour before dawn, and we managed to do this on 12 nights, banding on 19 nights altogether. In the end, we banded 210 Northern Saw-whet Owls (as well as two Barred Owls), with the peak of migration occurring on October 11th and 12th. The banding was done at our banding lab and the nets and audio lure were ~70m from the banding lab. The audio lure was a car CD player with a car speaker playing a 'tooting' saw-whet call that could be heard for 400m. A deep cycle 12-volt battery powered the CD player. We received $2,835 from the Public Conservation Assistance Fund, a sub-fund of the Habitat Conservation Trust Fund, administered by the Ministry of Water, Land and Air Protection. A large percentage of this money was spent on the deep cycle batteries, a solar panel, and a charge control unit, and batteries also powered a 12-volt, 30-watt florescent light in the banding lab.

Excellent coverage and additional nets helped make this our most productive banding season yet. In 2003, we are looking forward to marking the tenth season of migration monitoring at the Rocky Point Bird Observatory. Visit our website for more information and photo highlights at www.islandnet.com/~rpbo.

Table 1 Coverage effort from 1999-2002

Year	Coverage period	Days	Banded	Net hours	Birds/net hour
2002	20/07-21/10	87	3153	6509.5	0.48
2001	23/07-07/10	75	2576	4296	0.6
2000	21/07-21/10	90	2724	5113	0.53
1999	23/07-23/10	87	2255	4493	0.48

**2002 thirteen mist nets used*
**2000-2001 ten mist nets and three additional mist nets used on odd days*
**1999 ten mist nets used*

Table 2 Total birds banded and species totals from 1994-2002

Year	2002	2001	2000	1999	1998	1997	1996	1995	1994
Total banded	3153	2576	2723	2255	2127	1818	1571	1260	1547
Total species	56	54	57	61	59	52	62	62	60

**2002 total of 13 nets*
**2000-2001 nets 11-13 used only on odd days*
**1994-1999 total of 10 nets*

Appendix 1 Total birds banded in 2002.

Species Numbers	Banded	Species Numbers	Banded	Species Numbers	Banded
Sharp-shinned Hawk	*10*	House Wren	11	Chipping Sparrow	14
Northern Pygmy Owl	1	Winter Wren	177	Savannah Sparrow	74
Barred Owl	2	Marsh Wren	8	Fox Sparrow	*95*
Northern Saw-whet Owl	*211*	Golden-crowned Kinglet	*117*	Song Sparrow	*168*
Downy Woodpecker	1	Ruby-crowned Kinglet	*466*	Lincoln's Sparrow	148
Northern (Red-shafted) Flicker	2	Blue-gray Gnatcatcher	1	Swamp Sparrow	1
Traill's (Willow) Flycatcher	*47*	Swainson's Thrush	62	White-throated Sparrow	1
Hammond's Flycatcher	23	Hermit Thrush	53	White-crowned Sparrow	*96*
Dusky Flycatcher	1	American Robin	15	Golden-crowned Sparrow	66
Pacific-slope Flycatcher	271	Cedar Waxwing	*7*	Dark-eyed (Oregon) Junco	63
Hutton's Vireo	4	Orange-crowned Warbler	150	Red-winged Blackbird	8
Warbling Vireo	11	Northern Parula	1	Brown-headed Cowbird	7
Steller's Jay	8	Yellow Warbler	114	Purple Finch	6
Violet-green Swallow	4	Yellow-rumped Warbler	31	House Finch	6
Northern Rough-winged Swallow	2	Black-throated Gray Warbler	4	Pine Siskin	9
Chestnut-backed Chickadee	*93*	Townsend's Warbler	2	American Goldfinch	*159*
Bushtit	45	MacGillivray's Warbler	*48*		
Red-breasted Nuthatch	4	Common Yellowthroat	74	Total Individuals	3365
Brown Creeper	9	Wilson's Warbler	231	Total Species	57
Bewick's Wren	34	Black-headed Grosbeak	1		
		Spotted Towhee	88		

**Italics indicates new season high for this species*

Wildlife Tree Stewardship Initiative

Gwen Greenwood

8590 Alec Road, Saanichton, BC V8M 1S4
Tel: (250) 652-2876 • Email: tggreenwood@shaw.ca

Permit No.: P074-02
Location: Rocky Point

Start Date: January, 2002
Completion Date: December 31, 2002

Project Overview

The Bald Eagle Nest Tree (BENT) monitoring program began in 2000 to build an inventory of Bald Eagle nest trees and to document eagle productivity and tree condition.

In July 2001, the Wildlife Tree Stewardship Initiative (WITS) was formed with the goal to create, coordinate, and assist a network of community stewards committed to conserving coastal wildlife tree habitats through volunteer monitoring, landowner agreements, and community education along the Strait of Georgia.

Monitoring began at CFAD Rocky Point with two nest trees in 2001 and continued in 2002, as part of WITS, with a third nest tree. The monitoring will be carried out each year to provide a long-term observation of these sites. The project is supervised by Kerri-Lynne Wilson (WITS Stewardship Coordinator), Karen Morrison (MWLAP) and Terri Martin (WITS Technical Specialist).

Objectives

To monitor three eagle nest trees at CFAD Rocky Point.

Highlights of Findings to Date

Three eagle nests have been located and identified at CFAD Rocky Point. One is located just off the East Perimeter Road. This nest was active in 2001, not active in 2002. One nest is located on the south east side of Church Hill. This nest has not been active in 2001 or 2002. The third nest was discovered on the North West side of Church Hill in May 2002 and was active.

Research Activities

The three nests are located in first growth Douglas-fir trees. We were unable to access the base of either of the Church Hill trees. The active nest was monitored with a telescope from the road to the West of Church Hill.

Five visits were made throughout the year. The active nest produced two eaglets – last seen July 18th. The young did not fly during that observation.

In general, during our visits our observations indicated there were fewer eagles seen in the Rocky Point area in comparison to 2001.

Crassula connata Site Location

Harvey Janszen

251 East Point Rd., Saturna Island, BC V0N 2Y0
Tel: (250) 539-5150 • Email: hpjanszen@saturnacan.net

Permit No.: P083-02
Location: Rocky Point

Start Date: March 27, 2002
Completion Date: March 27, 2002

Project Overview
Crassula connata is known from 13 sites in British Columbia and a Red-listed species.

Objectives
1. Locate new occurrences of ***Crassula connata***; and
2. Relocate previously known sites of ***Crassula connata*** at Rocky Point and document the species current extent and population size.

Accomplishments to Date
There was one visit to Rocky Point on May 29, 2002. Several previously known locations for ***Crassula connata*** (Ruiz & Pavon) Berger var. ***connata*** were relocated and new locations were found for ***Callitriche marginata*** Torr. and ***Alopecurus carolinianus*** Walt. A previously known location for ***Phaeoceros hallii*** (Aust.) Prosk. was also confirmed.

Monitoring *Limnanthes macounii* and Other Rare Vascular Plants

Adolf Ceska and Oldriska Ceska

1809 Penshurst Rd., Victoria, BC V8N 2N6
Tel: (250) 477-1211 • Email: aceska@telus.net

Permit No.: P050-02
Location: Albert Head, Mary Hill, Rocky Point and CFMETR

Start Date: April 10, 2002
Completion Date: December 31, 2002

Project Overview

Macoun's meadowfoam (*Limnanthes macounii* Trel.) is a species endemic to southern Vancouver Island and several adjacent islands. It is the only native species of the genus *Limnanthes* in Canada along with False Mermaidweed (*Floerkea proserpinacoides* Willd.), one of two Canadian representatives of the family Limnanthaceae.

Macoun's meadowfoam is unique in the whole family by having floral parts in the multiple of four, whereas all other species of meadowfoam (*Limnanthes)* have floral parts in the multiple of five. The only other genus of the same family, False Mermaidweed has floral parts in the multiple of three.

Macoun's meadowfoam is known only from southern Vancouver Island and several other islands close to Vancouver Island. It has not been found on the mainland of British Columbia nor in Washington State.

Plants occur in seasonally wet depressions or along intermittent seeps in low elevations and usually close to the ocean. A majority of the sites are in open areas within Garry oak meadows. Several localities are in wet depressions in open Douglas-fir forests.

Macoun's meadowfoam is a winter annual which germinates in the fall after the first heavy rains and grows throughout the winter. It flowers in March and April. The flowers are self-pollinated and the ovary develops into the maximum of four nutlets. Plants shed the nutlets and die by the beginning of June.

Objectives

1. Monitor populations of Macoun's meadowfoam for a COSEWIC Status Report;
2. Find numbers and trends of Macoun's meadowfoam populations.

Population Sizes and Trends

Macoun's meadowfoam is known from 33 extant populations where it is represented by a total of 86 subpopulations.

On federal lands (DND properties, National Parks, National Heritage Sites and Government House), Macoun's meadowfoam occurs in 11 populations (that is one third of known extant populations) and 34 subpopulations (approximately 40 per cent of all known extant subpopulations).

We have monitored populations of Macoun's meadowfoam on federal lands during the winter of 2001/2002 and 2002/2003 and our monitoring effort resulted in the discovery of one new population (William Head Institution) and a total of 19 new subpopulations of this plant. The area of the Rocky Point property between Edye Point and Manor Point is especially rich in Macoun's meadowfoam and our search throughout winters 2001/2002 and 2002/2003 resulted in the discovery of 11 new subpopulations.

The size of a subpopulation of Macoun's meadowfoam varies and a majority of subpopulations are small (with fewer than 50 plants) or medium (50-200 plants). Only about eight subpopulations have more than 2,000 plants each. Three out of these eight large subpopulations occur on DND properties and one in the National Park on Fort

Rodd Hill (Yew Point). From all known populations of Macoun's meadowfoam in British, only eight subpopulations have more than 2,000 plants (Table 1).

Population dynamics of Macoun's meadowfoam is determined by many factors. The plant needs sufficient moisture during the winter months and it requires mild temperatures during its growing period. Since it can survive only short cold periods when the temperature drops below the freezing point, its distribution is restricted to the narrow band along the shore.

The main threat to its survival is the competition of introduced plants, especially perennial tufted grasses. It is a plant of open areas and cannot survive being shaded by shrubs. Scotch broom and perennial grasses are responsible for the disappearance of Macoun's meadowfoam from one subpopulation on the western side of Rocky Point and from two subpopulations at Mary Hill in places that are heavily infested with Scotch broom. With a single exception (Seabird site Table 1), subpopulations at Mary Hill have been declining and will disappear unless radical control of Scotch broom and other invasive species is undertaken.

Three seepages on DND properties are heavily used by Canadian geese. With the increase of goose populations in British Columbia in recent years, their impact on vegetation is significant. Since the geese graze mostly on perennial grasses, they create open habitat that favour the growth of Macoun's meadowfoam. All three subpopulations increased in size and Macoun's meadowfoam is thriving there. The increase of Macoun's meadowfoam in other subpopulations may be explained by suppression of grass/shrub competition by other factors (possibly the drought we have had during the last few summers that handicapped introduced perennial grasses).

Additional Information on Other Rare Plants

During our monitoring, we obtained information on the distribution of several other rare plants on DND properties and federal lands. In 1977, we found Dwarf stitchwort (*Minuartia pusilla* [S. Wats.] Mattf.) near Church Point and so far this is the only place where it has been found in British Columbia and Canada. In the past, we have not been able to confirm its occurrence on this locality until the spring of 2002. We also found several new sites with Seaside bird's-foot trefoil (*Lotus formosissimus* Greene), Coastal silverpuffs (*Microseris bigelovii* [Gray] Schultz-Bip.) and Foothill sedge (*Carex tumulicola Mackenzie*) among other interesting plant species.

Conclusions and Recommendations

The Department of National Defence and several other federal lands host a substantial part of the worldwide distribution of Macoun's meadowfoam. A large concentration of this species is along the shore in the eastern part of the Rocky Point property. The area between Manor Point and Edye Point hosts several significant subpopulations of this species. Training activities should be excluded from this particular area and the invasive introduced plant species (especially Scotch Broom) should be controlled. Radical Scotch broom control and restoration of open slopes at Mary Hill should also be initiated.

Table 1 Known subpopulations with more than 2,000 plants of Macoun's meadowfoam.

SW of Cape Calver, east of the road (Rocky Point)	DND
SW of Fossil Point, east of the road (Rocky Point)	DND
Small bay southwest of Mary Hill, its eastern side (Seabird site)	DND
Yew Point	National Park
Saxe Point	municipal
Cattle Point, between two boat ramps	municipal
Uplands Park, W margin of large vernal pool	municipal
Mrs. Rice's farm, promontory south of the house, juniper	private

Effect of Habitat Loss and Invasion by Scotch Broom on Rare Butterflies of Garry Oak Meadows

Wayne Hallstrom

Department of Biological Sciences, CW 405, Biological Sciences Building, University of Alberta, Edmonton, AB T6G 2E9
Tel: (780) 492-1180 • Email: wayne.hallstrom@ualberta.ca

Permit No.: P084-02
Location: Nanoose TX Site, Rocky Point

Start Date: April 1, 2002
Completion Date: August 31, 2002

Project Overview

Scotch Broom is a highly invasive weed from Europe which has dramatically altered the composition of the native vegetation structure. This species grows as a shrub and forms a dense layer, blocking the light, and shading out native herbaceous species which are adapted to open conditions of the Garry Oak meadows. These changes may negatively affect other species adapted to coexist with the native flora, including pollinators such as butterflies. In this region of BC, several species of butterfly have already been extirpated or seriously reduced in number, including Edith's Checkerspot (*Euphydryas editha*), the Propertius Duskywing (*Erynnis propertius*) and the Zerene Frittilary (*Speyeria zerene bremneri*). This study will examine the role of this weed and other factors affecting populations of these rare species.

Objectives

The aims of this study are to estimate the effect of habitat loss and fragmentation of meadows on rare butterfly and rare plant populations and to estimate the impact of continued spread of the invasive weed Scotch Broom on habitat quality; in particular how these two factors affect butterfly population persistence and viability. This will include a spatially explicit model of the population structure which accounts for habitat quality and population viability.

Accomplishments to Date

Some survey work was done at the Nanoose TX Site on Notch Hill. Relatively large populations of the blue-listed species (Special Concern) *Erynnis propertius* were noted at this location. No surveys were conducted at Rocky Point due to time constraints. Further surveys are planned for the summer of 2003. The time constraints of the previous summer will not be as much of an issue as the majority of the vegetation plots in the primary field sites on Saltspring Island and in Duncan are now complete.

Purple Martin Origins and Relationships

Cam Finlay[1] and Laura Darling[2]

[1] *270 Trevlac Place, R.R. 3, Victoria, BC V8X 3Z1*
Tel: (250) 479-9833 • Email: j&cfinlay@telus.net
[2] *Park and Protected Areas Branch, Ministry of Water, Land and Air Protection*
Tel: (250) 387-4661 • Email: laura.darling@gems7.gov.bc.ca

Permit No.: P044-02
Location: Colwood

Start Date: July 1, 2002
Completion Date: August 30, 2002

Project Overview

The Purple Martin (*Progne subis*) is on B.C.'s Red List and it is found nesting at the Colwood site – one of 14 known colonies of man-made nestboxes in B.C. Nestlings banded at 11 sites from 1997 to 2002 have been re-sighted at different colonies than their natal colonies. We suspect the B.C. colonies represent a single intermixed population but further confirmation is required. Purple martin populations are on the increase in B.C. and the American coastal states, and they appear to be recovering in association with the availability of man-made nestboxes. It is possible that the current population is derived from the few birds that adapted to man-made nestbox colonies. If so, Purple martin recovery may have been hampered by a genetic bottleneck and inbreeding.

Objectives

To continue banding nestlings in nestboxes at the site, to monitor nest success and productivity, and to monitor for band returns, as part of an on-going nestbox monitoring and maintenance program.

Highlights of Findings to Date

A total of 58 nestlings were banded in 2002, down from 123 nestling Purple Martins banded at the site in 2001 and up from 119 plus one adult in 2000. Of the 51 solid nestboxes at the site, 33 had eggs or young but only 27 had live young at the time of banding with six boxes failing to produce young at the time of banding. One box had four young too small to band. Productivity at the DND colony this year was way down probably because of the bad weather during the nesting season (2.15 eggs per pair recorded, down from 4.56 in 2001). Twelve previously banded nestlings from this site were observed at this site in 2002 and eight were banded at other colonies. Band returns from this site constitute 15 per cent of this year's re-sightings. This low percentage is most likely due to fewer efforts at the Colwood site as compared to the other sites.

Research Activities

No blood samples were taken in B.C. this past year. However additional samples were taken as part of this study in California, Ontario and Pennsylvania. The analyses of these samples and the integration of the results with Oregon, Washington and B.C. samples is still ongoing through the Avian Genetics lab at the Royal Ontario Museum (Centre for Biodiversity and Conservation Biology) for mitochondrial DNA control region sequencing analysis by Dr. Alan Baker. Preliminary analyses of half the samples indicated significant genetic difference of the west coast population from the eastern sub-species, and the variation within the west coast population was greater than that within the eastern samples. The completion of the analyses is underway with a small amount of funding yet to find.

Extension and Demonstration

A paper is being resubmitted describing the productivity and inter-colony movements of Purple Martins in B.C. and the Pacific northwest, 1996 to 2000, including data from the DND colony.

Measurement of Fungal Biodiversity on Cut Alder Logs

Dr. Brenda Callan

Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre,
506 West Burnside Rd., Victoria, BC V8Z 1M5
Tel.: (250) 363-0744 • Email: bcallan@pfc.cfs.nrcan.gc.ca

Permit No.: P047-02
Location: Rocky Point

Start Date: September 1, 2000
Completion Date: September 1, 2002

Project Overview

There are few tested sampling protocols for studying the biodiversity of pioneer saprophytic fungi on thin-barked trees. This project was designed to develop a sampling technique that is reliable, using trees that are easily accessed from Pacific Forestry Centre, yet are relatively protected from vandalism. The mature alder stands at Rocky Point provided excellent study sites because they are protected and relatively undisturbed. Large, windthrown alder logs on the site currently are known to serve as repositories for a number of pyrenomycetes unknown from other regions North America (ref. to report on Permit P047-98). Although some preliminary species lists have been compiled we previously had no data on how and where saprophytic fungi developed on the trees after they fell, and how the decay succession took place. For comparison purposes, we started with similar-aged sound trees that were dropped *in situ* and monitored for two seasons.

Objectives

We felled six *Alnus rubra* logs (mature) with intact bark and no external indicators of decay to measure the pattern of fruiting body development of saprophytic fungi (pioneer decay fungi, predominately ascomycetes). This study will also generate biodiversity (host-fungus association, frequency) data.

Accomplishments to Date

A total of six trees were selected, three at each of two different alder stands. One site, closer to Whirl Bay was slightly drier than the other site , which was in an area covered with swordfern adjacent to seasonally inundated swamp and skunk cabbage patches. In late October 2000, the two alder stands were surveyed for candidate trees while still bearing some foliage, to ensure that only trees with sound crowns (no dead tops or branches) were chosen. The six candidate trees were flagged, and on November 21, 2000 after most of the leaves had fallen, they were cut down. Length, diameter, aspect, and slope of each tree was recorded. The trees were also marked with signs and orange and black-striped flagging tape.

The first survey for fungi took place in February, 2001. At that time, no fungi had begun to fruit from the bark, but the epiphytic lichens and mosses were beginning to die on the trunks due to shading and the death of the host bark. Tracts of dead lichens were decayed by the basidiomycete saprophyte *Botryobasidium laeve*, which covered the thalli with whitish webs of hyphae. Due to the lack of fruiting, of other fungi, the entire exposed bark surface of each tree was closely examined for saprophytes but very few were found at this time.

The second measurement took place in June, 2001. By this time, the logs were covered in large areas by masses of pimple-like fungal fruiting bodies (pycnidia) breaking through the bark. The fruiting bodies had begun to exude masses of spores (conidia) in tendrils. At this time the sampling procedure followed the protocol detailed in the permit application. To briefly summarize this procedure, each tree was sampled at half-metre intervals along the length of the trunk that was greater than 20 cm in diameter. At each interval, a band of bark 10 cm wide was divided into 4 quadrants, and the per cent area covered by each type of fungus fruiting body encountered was estimated and recorded. Small (1cm diameter) discs of bark were excised and collected, so that the fungi could be microscopically examined and cultured to confirm field identifications. Over 50 cultures were initiated from these collections, and some required incubation and transfer to specialized agars in order to induce sporulation, a process that took up to 6 months. Over 90% of the fungi isolated were, in order of occurrence:

Measurement of Fungal Biodiversity on Cut Alder Logs

- *Pseudovalsella thelebola*
- Asexual stage of Diatrypaceae (a *Eutypella* sp.)
- *Melanconis marginalis*

The third survey was initiated on October 10, 2001, but was interrupted due to increased security measures on DND land. The survey was completed in January 2002. In January, some of the earliest formed fruiting bodies of the fungi observed in June were beginning to senesce, and were rapidly becoming colonized/parasitized by a fungicolous ascomycete, *Cosmospora episphaeria*. Log #1 at the drier site was colonized at the cut end by the basidiomycete *Chondrostereum purpureum*, which was beginning to decay the wood. This fungus was fruiting prolifically on the bottom two metres of the tree.

The fourth survey took place in June 21, 2002. The overall pattern of fruiting was superficially similar to that observed in the two previous surveys, but additional fungal species were beginning to layer over the initial bark fruitings. The most prominent new arrival was *Rosellinia cf corticium*, which colonized large (occasionally >0.5 m long) tracts of the predominately lower quadrants of the trunk. These quadrants afforded higher levels of moisture and shade.

Data are being entered into spreadsheets as the fungi are identified, so that populations on the tree can be mapped over time. At this time we have not measured any significant differences between the mycota at the two sites, but some final data are still being processed, and specimens are still being added to the Herbarium at Pacific Forestry Centre.

Monitoring of Winter Moth and the Parasites Introduced for its Control

Imre S. Otvos

Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre,
506 West Burnside Road, Victoria, BC V8Z 1M5
Tel: (250) 363-0620 • Email: iotvos@pfc.cfs.nrcan.gc.ca

Permit No.: P031-02
Location: Colville Officer's Mess on Hotham Street

Start Date: May 1, 2002
Completion Date: May 31, 2002

Project Overview

The winter moth, *Operophtera brumata* L., is an introduced pest that originated in Europe. It was first introduced into Nova Scotia in 1949, and was first detected in the Victoria area in 1976. By 1977, this insect was defoliating over 120km^2 on southern Vancouver Island. Its principal host on southern Vancouver Island is the Garry oak (*Quercus garryana* Dougl). In 1979, the Canadian Forest Service commenced the introduction of two natural enemies of this insect, both from Europe and from Nova Scotia, where a similar introduction program had been successful. The natural enemies, a parasitic wasp (*Agrypon flaveolatum*) and a parasitic fly (*Cyzenis albicans*) were released over a four-year period at up to 33 different locations in the Greater Victoria area. One of these locations was adjacent to the Colville Officer's Mess on Hotham Street. Following the completion of the release program in 1982, a monitoring program was established to track the success of the introductions and the stability and value of the newly established host-parasite complex.

Objectives

To monitor the current population density of the winter moth at Hotham Street, one of the sites was used for parasite releases between 1979 and 1982 for comparison with data collected during the last 20 years. Winter moth larvae will be collected and reared to determine percent parasitism by the introduced parasites at this and other sites in the Greater Victoria area. These data will be compared with those collected in previous years to determine whether the introduced parasitoids have become established and are effective in controlling winter moth populations.

Highlights of Findings

In 2001, winter moth populations averaged 0.05 larvae per leaf in the Greater Victoria area, while in 2002 the population had almost tripled to 0.14 larvae per leaf. This population density caused trace damage (defoliation) to the leaves. There was a corresponding, although not as great an increase in winter moth populations in the Colville Officer's Mess area, with populations increasing from 0.03 to 0.04 larvae per leaf. These winter moth populations are lower than the regional average, but are not unusual for the Colville location – winter moth populations at this sample location have almost always been lower than the overall average population levels for the Greater Victoria area. The increase in the winter moth population is slight, and population levels at the Colville location have reached higher levels in the past before collapsing. One cannot predict if the population levels will continue to increase over the next 2-3 years, or if the population will return to its previous endemic levels, but the monitoring will continue in the Greater Victoria area.

Percent parasitism by *Cyzenis albicans* and *Agrypon flaveolatum* during the spring of 2002 cannot be determined at this time because these parasitoids are currently overwintering in the host pupate, and will not emerge until next spring in the growth chamber at the Pacific Forestry Centre. However, the following general statements can be made. Parasitism by *Agrypon flaveolatum* is likely to remain low as this parasite has never been found in more than 6% of winter moth larvae collected in a single year since its introduction 20 years ago. On the other hand, parasitism by *Cyzenis albicans* will probably increase. The biology of *Cyzenis albicans* makes it an important controlling factor for the winter moth when the populations are high. If the two insects (winter moth and *Cyzenis*) follow the pattern

observed during the previous population increase in Greater Victoria (1991-1996), then percent parasitism by *Cyzenis* is likely to increase as the winter moth population increases until the winter moth population "crashes" and no noticeable defoliation can be observed. The parasitoids will not eliminate the winter moth, but will reach a "balance" or equilibrium, with the host and parasitoid populations fluctuating around this equilibrium.

In conclusion, the results of the past 20 years of monitoring winter moth populations in the Greater Victoria area would suggest that the introductions of the two parasitoids, *Agrypon flaveolatum* and *Cyzenis albicans*, particularly the latter, has resulted in control of the introduced winter moth in the Greater Victoria area. The case for the establishment of a stable host-parasitoid complex is however complicated by the two gypsy moth treatments that were conducted in 1998 and 1999 in the Greater Victoria area to eradicate the gypsy moth. These applications of the bioinsecticide, *Bacillus thuringiensis* subsp. *kurstaki*, or *Btk* (a naturally occurring soil bacterium) also reduced winter moth populations on the previous occasion when it appeared that the winter moth populations would increase. The application of *Btk* may have disrupted the equilibrium reached between the winter moth and the two introduced parasitoids. It may take several years for this equilibrium to be re-established. Therefore, it is important to continue the monitoring of these insects to observed the long-term interaction and stability of the winter moth and parasitoid populations.

Research Activities

In order to monitor winter moth populations and the interaction between the host and parasites, two sampling methods are employed. Winter moth population densities are determined by making collections of branches from oak trees at six permanent sample locations, one of which is located on Department of National Defence land. These branch samples are collected when it is determined that the larvae have reached late 3rd or early 4th instar. Four trees are randomly chosen at each of the permanent sample locations. A pole pruner with a basket attached below the cutting head is used to collect an oak branch that has newly flushed leaf clusters. The branch is cut so that it will fall into the basket, and any larvae that are dislodged will be retained in the basket. The branch is then cut into smaller pieces and placed into a 20 lb brown kraft paper bag along with the contents of the basket attached to the pole pruner. The bag is then sealed and the process repeated until five branches have been collected from each of the four trees (for a total of 20 branches) at each sample location. The samples are then taken to the Pacific Forestry Centre and stored in a cold room at –20°C until they can be examined to count the number of winter moth larvae, leaves and leaf clusters on each branch. Winter moth larval densities are then expressed as the number of larvae per leaf or leaf cluster to monitor changes in the populations over time.

Parasitoid populations are monitored when the larvae have reached early to late 4th instar. Winter moth larvae are collected and reared in the laboratory because the parasitoid larvae hatch and feed inside the host, and cannot be identified until they complete development later in the year. Depending on the rate of insect development one or two collections may be taken to ensure that parasitized winter moth larvae are collected. Trees are selected at random in the permanent sample location. A large (2 m x 3 m) white sheet is placed on the ground part of the crown of one tree, and a 2 m pole is used to beat all the branches located over the sheet to dislodge the larvae from the tree. All the winter moth larvae that have fallen on the sheet are collected and placed in a cardboard bucket containing a layer of moist peat moss in the bottom for the mature larvae to pupate in and some oak foliage. This procedure is repeated until either 200 or more larvae are collected, or the amount of time required to collect the insects exceeds one hour. Once the larval collection at the location is completed, the bucket is covered with a fine mesh lid and the insects transported back to the Pacific Forestry Centre for rearing. The winter moth larvae are reared in the buckets until they spin down into the peat moss and pupate. Once the winter moth have finished pupating (usually the beginning of June), the peat moss is removed from the buckets and sieves are used to separate the winter moth cocoons from the peat moss, frass and oak debris. The cocoons are then placed in large (100 x 20 mm) petri dishes that contain a layer of moist sand covered with a filter paper. The filter paper and cocoons are moistened occasionally to prevent desiccation of the pupae. The pupae are reared at room temperature until mid-September, then transferred to a growth chamber and reared at 5-8°C until the spring. Adult moths usually start emerging around mid- to late November, while the parasites do not emerge until the spring.

Environmental Technology Program Field Trip

Dianne Humphrey

Environmental Technology Program, Camosun College, 3100 Foul Bay Rd., Victoria, BC V8P 5J2
Tel: (250) 370-3432 • Email: humphrey@camosun.bc.ca

Permit No.: P075-02
Location: Rocky Point Forest Canopy Research Station

Start Date: June 20, 2002
Completion Date: June 20, 2002

Project Overview

First year Environmental Technology students have an opportunity to view old-growth forest/canopy station. Students gain a 'first hand' impression of old-growth forest in order to compare it to a second growth forest and newly harvested areas.

Objectives

1. To introduce students to old growth forests; and
2. To view the forest canopy research station and learn about the canopy study.

Accomplishments to Date

The Spring 2002 ENVR TECH Yr 1 class toured Rocky Point under the guidance of Arthur Robinson on June 20, 2002. This class had an opportunity to view the canopy research station and experience the old-growth forest. They recorded information and impact of this area in their field notes for later comparison to a second growth forest and a newly forested area. The experience was extremely worthwhile and hopefully can be repeated in subsequent years.

Students learned about the gorse situation and the general history of the Rocky Point property. They will be able to draw upon this information in further program endeavors.

Extension and Demonstration

The class learned of the DND Natural Resources Program and ESAC.

Thermal Characteristics of Townsend's Big-Eared Bat Roosts

Dr. Vanessa Craig

EcoLogic Research, 406 Hemlock Ave., Gabriola Island, BC V0R 1X1
Tel: (250) 247-7435 • Email: vjcraig@shaw.ca

Permit No.: P086-02
Location: Mary Hill

Start Date: July 2002
Completion Date: July 2004

Project Overview

This project examines the temperature characteristics of current known roost sites of the provincially Blue-listed Townsend's big-eared bat (*Corynorhinus townsendii*, COTO) at the northern limit of its range. The project is funded by Bat Conservation International. Little is known about the roost requirements of Townsend's big-eared bats, especially in B.C. I placed temperature monitors at known maternity roost sites and hibernacula of COTO along coastal B.C., including the Mary Hill property. The data can be used to develop a profile of habitat requirements for this species in B.C. The project is scheduled to continue for three years to collect data suitable for publication in a scientific journal.

Objectives

1. Collect data on the temperature characteristics of known roost sites of the rare Townsend's big-eared bat, including the Mary Hill property;
2. Build bat houses suitable for Townsend's big-eared bats on Denman and Hornby Islands.
3. Compare the temperature profile of these bat houses with known roost sites to determine whether the design is suitable or should be modified; and
4. Write a scientific paper for publication in a scientific journal.

Highlights of Findings to Date

This project is able to build on the data collected from 1995-1999 by Dave Nagorsen (at that time with the Royal British Columbia Museum). In 1996, steel doors on tunnels were modified to be bat-friendly. Continued vandalism of the site prompted the ending of the project early in 1999.

Disturbance to the site appears to have decreased; all of the gates and locks were still in place during a visit in July 2002. Some disturbance of the bats is still occurring, however, DND staff visit the colony to take pictures; at least two staff members visited the site at different times in summer 2002 to take pictures of the bats. Although this level of disturbance is less harmful than typical types of vandalism, continued disturbance of the colony with flashes, and people approaching them at close range, is likely to negatively affect the colony. The disturbance to the colony occurred during July when bats are giving birth to pups, and/or pups are not yet able to fly. This species is known to be exceptionally sensitive to disturbance, which can lead to roost or pup abandonment. Access to the colony should be limited.

A rock has been placed against one of the gates over an air shaft beside Tunnel 1. This will decrease airflow to the shaft, and could change access and temperature regimes for the bats. The rock should be removed. The gate is made of round bars of hardened steel and should not be susceptible to vandalism (D. Nagorsen, *pers. comm.*).

The colony size appears to have increased slightly since the vandalism stopped with 30-35 bats (including pups) at the site in July.

Temperatures in the Command Post housing the maternity colony were very stable compared to outside temperatures, and tended to be warmer than ambient. The data for summer 2002 indicated that the Command Post had the coolest daily maximum of all the roosts monitored, but the daily minimum was quite warm. Maximum temperature recorded was approximately 26°C. Low temperatures were approximately 17°C. Temperatures in other roosts on Vancouver Island increased to 30°C to 40°C in the summer, and declined to lows of 13°C. Additional data collected in future years will provide a more complete description of temperature variability

within the Mary Hill roost, and a more complete description of habitat selection by COTO in B.C.

In October, a bat in torpor was discovered in Tunnel 1.

Research Activities

A temperature monitor was installed at the Command Post inside the room with the maternity colony, and another was placed outside on the north side of the building to measure ambient temperature. The monitors were removed in October.

Three temperature monitors were placed inside tunnels that were reported by Dave Nagorsen to provide habitat for hibernating bats, and one temperature monitor placed outside to record ambient temperature.

Extension and Demonstration

A progress report was submitted to Bat Conservation International (the funding agency).

Acknowledgements

The funding for this project is provided by Bat Conservation International. I thank David Nagorsen for supplying information about the history of the site and locations of bats. The Ministry of Water, Land and Air Protection supported this research.

Microclimate Station Upgrading

Dr. Bill Dushenko

Royal Roads University, 2005 Sooke Rd., Victoria, BC V9B 5Y2
Tel: (250) 391-2580 • Email: Bill.Dushenko@royalroads.ca

Permit No.: P087-02
Location: Rocky Point: Microclimate Station

Start Date: September 2002
Completion Date: December 2002

Project Overview

Royal Roads University (RRU) has received funding under the Canadian Foundation for Innovation - Research Development Fund (CFI RDF) for the development and augmentation of two meteorological and air chemistry sites at the RRU campus and Rocky Point, respectively. This long-term project is designed to monitor climate conditions and atmospheric pollutants (both local and long-range), as well as indicators of environmental health in the southern Vancouver Island node of the Georgian Basin, as part of a larger global monitoring network. One important component of this project is the acquisition of data by the microclimate station situated by the EMAN site below the forest canopy station at Rocky Point.

Objectives

The purpose of this project is to enhance the current capabilities of the existing microclimate monitoring station at Rocky Point including a remote download capability of monitoring information from the station's data-logger on a periodic basis. A solar panel and tower is to be installed on a rise behind the site to provide an adequate power supply for additional station equipment installed there, in addition to three soil moisture probes to be installed at selected locations in the EMAN site. A small storage shed for equipment and the data-logger is to be set up alongside the existing platform outside of the EMAN plot for the storage of equipment.

Activities

Rocky Point Forest Canopy Station:

- Removal of all sensors for testing and recalibration;
- Design of a new environmental sensing strategy (including new soil moisture probes) for the site;
- Acquisition of 60 ft. tower, solar panel, and aspirated shields;
- Installation of an aerial ladder to support temperature/Relative Humidity (RH) profile within the canopy;
- Canopy station maintenance inspection carried out in July 2002; and
- Currently awaiting new access permit for continued installation activities in 2003.

Church Hill/Christopher Point Ambient Air-Monitoring Station Feasibility:

- Survey of Church Hill and evaluation of feasibility as a long-term ambient air-monitoring site;
- Research of remote communication options for data recovery;
- Research of alternate power sources for Church Hill including solar, wind and fuel cell technology –later determined to be impractical for the remote site location, based on the resources required;
- Investigation of a new site at Christopher Point and on-going liaison with interested DND personnel;
- Investigation of cost benefit option of acquiring the existing wind turbine at Christopher Point – determined to be unfeasible; and
- Awaiting access permit and approval from DND to use the Christopher Point site, including the upgrade of existing materials (tower and trailer), and existing power lines.

Boathouse Ambient Air-Monitoring Station at Royal Roads Upgrades:

- Upgrading of 21X program to accept solar radiation data (variables RF-1 and RF-3);
- Replacement and rebuilding of wind sensor;
- Cleaning and calibration of tipping bucket rain gauge; and
- Liaison with Province of BC and CRD concerning operation of the ambient monitoring equipment.

Advanced Field Methods of Restoration Course

Richard Hebda

Restoration Program, Environmental Studies, University of Victoria,
P.O. Box 1700, Victoria, BC V8W 2Y2
Tel: (250) 472-4569 • Email: rhebda@royalbcmuseum.bc.ca

Permit No.: P041-02
Location: Royal Roads

Start Date: September 15, 2002
Completion Date: September 22, 2002

Project Overview

Provide instruction to students in observation of slope stability, terrestrial ecosystem mapping, stream monitoring using Royal Roads' gravel pit, forested ecosystems and Cottonwood Creek respectively.

Objectives

To instruct 18-20 senior Restoration students in advanced restoration techniques.

Accomplishments to Date

From September 16-20, 2002, fourteen students participated in the Advanced Field Methods course visiting several sites and collecting data according to Provincial standards required for terrestrial ecosystem mapping. Observations were made on species cover, soil texture, site topography, moisture regime, and other factors. Student plots were located in the Douglas-fir, Garry oak and Western redcedar-dominated stands mostly east of Cottonwood Creek. Terrestrial ecosystem data were also collected in the estuary of Cottonwood Creek. Students were shown how to take standard measurements such as temperature, dissolved oxygen and others in the creek itself at the foot bridge. Students were instructed in collecting slope stability data and carried out an assessment in the gravel pit off Metchosin Road. Four groups surveyed four transects from the top of the pit to the bottom observing and recording critical features. They also recorded species cover for different plant species in the pit and placed the communities in order of seral stages. Sketch maps of seral stages were prepared. Students also learned how to assess wildlife trees.

The students also each prepared a Terrestrial Ecosystem Map for the Royal Roads area, marked by the instructor.

Extension and Demonstration

The project was a university credit course toward the Restoration of Natural Systems Diploma.

Notes

An application to use the same lands to teach to the same course at about the same time will likely be submitted in the coming summer.

Oregon White Oak Acorn Production Study

David Peter[1] and Paul Courtin[2]

[1] Ecologist, Constance Harrington, Research Forester U. S. Forest Service, Olympia Forestry Sciences Laboratory, 3625 93rd Avenue SW, Olympia, Washington 98512-9193 • Email: dpeter@fs.fed.us
[2] BC Ministry of Forests, 2100 Labieux Rd, Nanaimo, BC V9T 6E9
Tel: (250) 751-7120 • Email: Paul.Courtin@gems7.gov.bc.ca

Permit No.: P079-02
Location: CFMETR, Mary Hill and Rocky Point

Start Date: September 3, 2002
Completion Date: September 30, 2002

Project Overview

The Oregon white oak (a.k.a Garry oak) acorn productivity study was initiated in the summer of 1999 to explore factors influencing acorn production. Reasons for doing this study include: 1-Oregon white oak ecosystems are rapidly disappearing or changing due to introduction of exotics and fire suppression; 2 - Acorns are a rich source of food for many wildlife species; 3 - Acorns are important for regeneration and dispersal of the species. There is very little published information on acorn crop sizes in Oregon white oak. This is intended to be long-term project. We anticipate a minimum of 10 years data collection in order to evaluate periodicity in acorn production and climatic influences.

Objectives

The project will determine how common good and bad acorn crops are, the variation in production between places and the environmental and biological factors that influence production. We want to understand the conditions contributing to both individual tree and stand level production. This includes both local and regional environmental factors and biological interactions including acorn predation and community succession. We want to obtain as wide a sample as possible to determine if regional differences in acorn production exist. Because Oregon white oak has a wide latitudinal range and the sampling season is short (less than 2 months) we recruit volunteers and cooperating agencies to help with a simple survey following procedures published by Graves (1980). To assist volunteers and the public we have created a website with background information, methods and forms used in the survey and results of the survey (www.fs.fed.us/pnw/olympia/silv/oaksurvey/oak.htm).

Accomplishments to Date

We have completed four years of data collection. Last year (2002) was the second year we obtained data from British Columbia. With the assistance of Kevin Brown (a contractor) and Paul Courtin, B.C. Ministry of Forests, acorn production on 203 trees (up from 54 trees in 2001) from 11 locations are now being tracked on or near Vancouver Island. Observations of acorn production have also been made from Vancouver Island to southern Oregon with the help of volunteers and cooperators. To date, more than 1200 trees have been sampled of which 241 have been sampled in four years and 264 in three years.

The results of the 1999 survey were analyzed and published in Northwest Science (Peter and Harrington 2002). Data from 1999 and 2000 are available in summarized form from our website: www.fs.fed.us/pnw/olympia/silv/oaksurvey/oak.htm. Other information about the project including background, protocols and contact information are also available on the website.

Data collected in 2001 and 2002 is being prepared for analysis therefore no results are available. When analysis is complete, the website will be updated with the new results.

Results from previous years indicate that acorn production is influenced by competition (measured by basal area, tree shape and crown contact), moisture (indicated by precipitation, available soil water capacity, and moisture index), age, and fire history. Productivity tends to be highest on well watered, but well drained sites on trees at least 60-80 years old growing under little competition from neighbors. Our data also suggests that prescribed underburning may reduce acorn production in the year immediately following burning, but may also

contribute to higher production 6-10 years after underburning. The year 2000 data provides the first indication that there are regional differences in levels of production. Production was much higher east of the Cascade Mountains than to the west and somewhat higher in southern Oregon than in the Willamette Valley or Puget Trough. The difference is even more striking if only the moist sites are compared. The moist sites on the east side of the Cascades and in southern Oregon produced at the acorn class 4 level whereas similar sites in the Willamette Valley and Puget Trough did not produce much differently than dry sites.

References

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Peter, D. and C. Harrington. 2002. Site and tree factors in Oregon white oak acorn production in Western Washington and Oregon. Northwest Science, 76(3): 189-201.

Pilot Monitoring Program for Terrestrial Salamanders

Kathy Paige

Ministry of Water, Land and Air Protection, 2975 Jutland Rd., Victoria, BC - P.O. Box 9374 Stn Prov. Gov
Tel: (250) 356-7788 • Email: Kathy.paige@gems4.gov.bc.ca

Permit No.: P088-02
Location: Rocky Point and Royal Roads

Start Date: October 2002
Completion Date: Phase 1 - November 30, 2002

Project Overview

Terrestrial plethodontid salamanders (family Plethodontidae) possess many characteristics that render them potentially excellent indicator organisms for monitoring changes in environmental quality and ecosystem functions. These characteristics include a highly permeable skin and eggs, sensitivity to changes in moisture and temperature conditions, and an important position in the foodweb both as consumers of soil and litter invertebrates and as prey for larger animals. Recently, EMAN and Parks Canada jointly developed a standardized protocol for monitoring salamander populations. The protocol is still to be tested in western Canada. We propose to develop and implement a model monitoring program for terrestrial salamanders and to test associated methodological issues at the Rocky Point EMAN site. This model could then be applied to other EMAN sites in British Columbia, as needed.

Two 1 ha EMAN plots exist at Rocky Point: one in old-growth Douglas-fir dominated stand and the other in a Garry oak stand. Salamander monitoring was initiated at these sites with the deployment of artificial cover-boards in 1996. The boards have been inspected for salamanders sporadically since then, and their present condition is unknown. We plan to take advantage of the existing boards to determine sampling parameters needed for a comprehensive, standardized monitoring program.

Objectives

1. Collect data on the abundance of plethodontid salamanders at the Rocky Point and Royal Roads EMAN sites as an initial step for establishing a monitoring program;
2. Determine sampling parameters (such as statistical power for detecting trends; sample size required) from preliminary data; and
3. Set up a pilot monitoring program using artificial cover-objects.

Accomplishments to Date

In November 2002, we initiated activities to design and implement a pilot monitoring program for terrestrial salamanders at two sites on southern Vancouver Island. We assessed two EMAN plots at Rocky Point and the Upland Ecological Monitoring Plot on the Royal Roads University campus in the District of Metchosin for their suitability for this purpose.

Our activities to date have included the following:

- Inspection of existing salamander boards at the Rocky Point site.
- Quadrat searches for salamanders at Rocky Point.
- Assessment of suitability of the two Rocky Point EMAN sites and the Royal Roads site for a salamander monitoring project.
- Salvage of existing boards from the Rocky Point site.
- Set up of boards (old and weathered) at two sites (old-growth plot at Rocky Point and uplands plot at Royal Roads).

Rocky Point Plots

In October 2002, we inspected existing amphibian boards twice on the old-growth fir plot and the Garry oak plot (24 boards/plot, set up in 1996). At the old-growth fir plot, there were 17 and eight Western Red-backed Salamanders under the boards during the two inspections, respectively. During the peak activity period of the salamanders in spring, the numbers of salamanders using boards are expected to be higher. At the Garry oak plot, there were no salamanders using the boards. Similarly, during sporadic previous inspections, the Western Red-backed Salamander was found on the old-growth coniferous plot but not on the Garry oak

plot. The Rough-skin Newt and Long-toed Salamander have been found on the Garry oak plot in the past, but this plot is probably too dry for plethodontid salamanders. A salamander monitoring project on this plot is not feasible, and consequently, we removed the existing boards from the plot.

Data from the existing artificial cover-objects indicate that the old-growth coniferous plot provides suitable habitat for salamanders, and in December 2002 we set up salamander boards around the periphery of three 20 m x 20 m quadrats (Figure 1). This arrangement of perimeter boards, recommended by the new Parks Canada/EMAN standards, links the boards with vegetation and other data that are collected for the associated quadrat but does not disturb the quadrat itself. Each of the three plots of salamander boards consists of 15 boards, 5 of which are weathered (salvaged from the previous set) and 10 are new. As boards improve in their effectiveness for salamanders as they age, the use of weathered boards provide a head-start for the project. We removed all old boards from this plot, most of which were no longer usable.

On 13 November, we searched 45 1 m x 1m quadrats along transects set in old-growth coniferous forest habitat outside of the 1 ha EMAN plot. The search resulted in the finding of only one Western Red-backed Salamander. Unusually dry late summer and autumn probably accounted for the poor results. Although the search took place after several days of heavy rain, moisture had barely penetrated the forest floor. Consequently, we postponed any further quadrat searches to the spring.

Royal Roads Plots

The Upland Monitoring plot at the Royal Roads University campus is in mature second growth coniferous forest and consists of four 20 m x 20 m vegetation quadrats. A brief search of the area around the quadrats in November 2002 revealed the presence of the Western Red-backed Salamander. We selected three of the quadrats for monitoring salamander populations, and in December 2002 set up perimeter boards around them (Figure 2). The arrangement of boards is similar to that at the Rocky Point site, and each of the three plots consists of 15 boards, 5 of which are weathered and 10 are new. The weathered boards originated from salvaged boards from the Rocky Point site and were pressure-washed before installation to remove any adhering soil and other particles.

Future Activities

Activities to be completed include the following:

- Inspection of the boards at both sites in March.
- Quadrat searches at both sites in March, weather conditions permitting.
- Design of a monitoring program, including modeling of sampling parameters and development of a replacement schedule for the boards.
- The Roads Road University team will be installing temperature and soil moisture sensors on both plots, and these data will be available for the salamander monitoring project.
- Additional inspections of the boards should be carried out in April – May and September – October 2003.

See figures next page...

Pilot Monitoring Program for Terrestrial Salamanders

Figure 1: Location of salamander boards at the Rocky Point EMAN plot (Plot 1, old-growth Douglas-fir habitat). The boards are shown larger than life (each board is 3' long). Numbers indicate those for 20 m x 20 m quadrats.

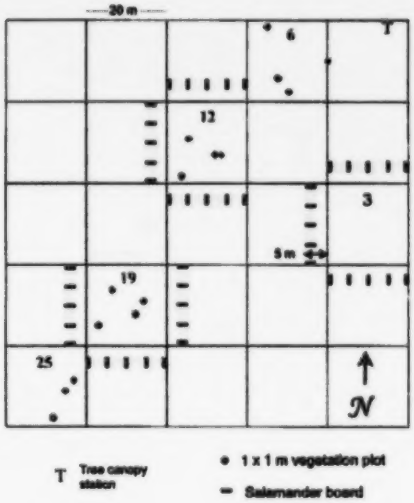
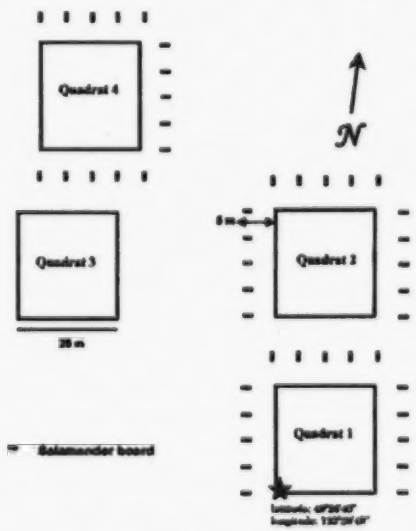


Figure 2: Location of salamander boards Upland Forest Ecological Monitoring Plot at Royal Roads University campus. Quadrats 1 to 4 represent 20 x 20 m vegetation plots. The boards are shown larger than life (each board is 3' long).



Ecological Monitoring and Assessment Network (EMAN) Plot Surveys

Dr. Bill Dushenko

Royal Roads University 2005 Sooke Rd., Victoria, BC V9B 5Y2
Tel: (250) 391-2580 • Email: Bill.Dushenko@royalroads.ca

Permit No.: P085-02
Location: Rocky Point and Royal Roads EMAN Sites

Start Date: May 2002
Completion Date: December 2002

Project Overview

Royal Roads University (RRU) has received funding under the Canadian Foundation for Innovation - Research Development Fund (CFI RDF) for the development and augmentation of two meteorological and air chemistry sites at the RRU campus and Rocky Point, respectively. This long-term project is designed to monitor climate conditions and atmospheric pollutants (both local and long-range), as well as indicators of environmental health in the southern Vancouver Island node of the Georgian Basin, as part of a larger global monitoring network. One important component of environmental health being investigated is the encroachment of invasive species and their effect on species diversity and ecosystem health in endangered Douglas-fir forests of southern Vancouver Island.

Objectives

The objectives of the project was to investigate the occurrence and encroachment of invasive species and their effect on species diversity and ecosystem health in endangered Douglas-fir forests of southern Vancouver Island, using representative forest ecosystem plots at Royal Roads and Rocky Point.

Research Activities

Introduced species were inventoried and their effect on community biological diversity was examined in selected forested sites at Royal Roads. Two long-term 1-ha study EMAN plots have been previously established along the forest periphery, in areas of human activity. Four modified 20 m^2 EMAN plots were also established in the relatively undisturbed interior forest for comparison in the summer of 2003 and an established 1-ha EMAN plot at Rocky Point was used as a control site. Percent cover of ground vegetation species was determined within 128 randomly placed 1 m^2 permanent vegetation plots nested within the study sites.

Highlights of Findings to Date/Project

A significant positive correlation was found between biological diversity (Shannon index) and percent introduced species. The presence of introduced species was also significantly greater within the periphery plots, with the greatest presence found along the disturbed edges - up to 81% cover on average. Dominant introduced species included *Daphne laureola*, *Agrostis capillaries*, and *Holcus lanatus*. Introduced species were also detected in the interior forest sites (average 3.4% cover), which suggest the need for an effective invasive species management plan. The broader implications of introduced species invasion with respect to ecosystem management issues and restoration initiatives were also examined.

Extension and Demonstration

A report on the above research activities has been provided to EMAN under the Environment Canada Science Horizon Project, which provided the operating (research intern salary) funds for the project. The findings are also being reported as a paper presentation:

Bailey, J and W.T. Dushenko, 2003. *Ecological monitoring of introduced species in Douglas-fir forest ecosystems on southern Vancouver Island in the Georgia Basin*, at the 2003 Georgia Basin/Puget Sound Research Conference in March, 2003, and included as part of the published proceedings.

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DND-Sponsored Environmental Projects in 2002

Investigation of Site Usage and Disturbance of Double-crested Cormorant *(Phalacrocorax auritus)* Winter Roost Site at Rocky Point

Kym E. Welstead[1] and Ross G. Vennesland[2]

[1]*405 - 1528 East 5th Ave., Vancouver, BC V5N 1L7*
Tel: (604) 254-4445 • Email: kwelstead@telus.net
[2]*FIA Species at Risk Recovery Biologist, BC Ministry of Water, Land and Air Protection*
Tel: (604) 582-5279 • Email: Ross.Vennesland@gems4.gov.bc.ca

Summary

Double-crested Cormorants were surveyed fortnightly at the Rocky Point winter roost site near Victoria, British Columbia (BC) from September 2002 to March 2003. Cormorants have been using this site since 1995. The highest observed abundance was 680 individuals recorded on 8 November, making this an important roost for resident BC populations and possibly for migrating Alaskan cormorants. The roost site consisted of a strip of trees along the north and south shores of Pedder Bay and was primarily used by sub-adults (mean of 76%). The roost is predominately a nocturnal roost site with infrequent diurnal use. The majority of the cormorants vacated the roost site approximately three hours after sunrise and returned in the evening approximately two hours before sunset. However, daily usage varied throughout the season, with more cormorants using the roost throughout the day during the period of peak abundance. Tidal heights did not influence the number of cormorants using the roost site. The majority of the roost trees were located in a mature stand of Douglas-fir (>140 years old), but we did not detect any preference for particular tree heights or widths. The mean height of the trees used was 23.8 m and mean diameter at breast height (dbh) was 79.5 cm. The total roost area used by the cormorants was 5874 m^2.

The roost appeared habituated to low-level human disturbance. However, moderate to high human disturbance levels, including people on the docks, large 'bangs', boats, vehicles and the presence of dogs resulted in groups of cormorants temporarily abandoning the roost site (*i.e.* a flush response). The presence of people on the DND and Pearson College docks disturbed the cormorants when making noise such as yelling or banging. This disturbance resulted in a 36% flush response (the proportion of observations resulting in ≥1 cormorant flushing). Boat traffic resulted in a flush response of 23%. Although this is relatively low compared to other disturbances, the actual number of boat disturbance events was high because the birds experienced frequent and daily boat traffic. In addition, this high frequency of stimulation means that the potential for habituation was high. A set-back distance of 61 m was calculated (*censu* Rodgers and Smith 1995) for people walking under the colony. This set-back would ensure the cormorants are not disturbed by regular pedestrian activity near the roost.

The natural interaction of Eagles and Red-tail Hawks disturbing the colony had the largest effect on the roost with large parts of the colony responding 80% of the time. Concern over increasing predator populations is discussed.

Focal group observations enabled us to detect more sensitive responses to disturbances, which included observations of increased vigilance. The presence of people, boats, loud bangs, vehicles, eagles, helicopters, and dogs all led to either an increase in vigilance or a flee response in some cormorants.

Disturbance may indirectly affect the survival of adult and sub-adult cormorants, making mitigation of this threat important. With depleted numbers of breeding pairs in BC and K-selected life history traits, recruitment of new breeders and protection of adult cormorants is crucial. Management recommendations include habitat protection, reduction of disturbance through temporal isolation and area buffers and education/outreach programs in the local community.

Deer Habitat Study in Dockyard, CFB Esquimalt

Mark A. Fraker

TerraMar Environmental Research Ltd., 8617 Lochside Drive, Sidney, BC V8L 1M8
Tel: (250) 656-3972 • Email: maf@terramarresearch.com

Summary

This project assessed the status of the Black-tailed Deer (*Odocoileus hemionus columbianus*) population at CFB Esquimalt (Dockyard). Specific objectives were to:

- Determine population size and composition;
- Determine movement patterns and home range size;
- Assess deer health and condition;
- Assess deer habitat quality;
- Assess human health and safety issues; and
- Identify options for managing the population.

Four adult does, three fawns, and one spike buck were captured and marked with ear tags. The does were also fitted with radio collars and the buck with a radio attached to an ear tag, which permitted them to be readily located and followed. At capture, the deer were weighed, body condition assessed, blood samples drawn, and external parasites collected.

In Fall 2002, we believe that CFB Esquimalt was home to about 26 deer (11 adult does, 11 fawns, and 4 antlered bucks). There were two centres of habitation: 1) the area near the Admiral's and Commodore's residences and 2) Signal Hill. Generally, the does were more sedentary than the bucks, usually staying within about 400 m of the capture site. However, some deer moved between the two habitation centres, sometimes only for a few hours, sometimes for days or weeks.

The weights of does and fawns were close to published values, suggesting that the deer were adequately nourished. Overall assessments suggested that the animals were in good condition, but none were fat. Three does were accompanied by twin fawns, suggesting that the does were in above-average condition at the time of conception and that they were well enough nourished to have supported normal growth of their fawns. Thus, the deer have not yet exceeded the biological carrying capacity of their environment. During the study, two deer were known to have died: one collided with a transit bus, while the other died of unknown causes.

Deer carried relatively large numbers of chewing lice and keds, but no ticks were found. Because ticks are necessary to carry Lyme's Disease, we found no reason for concern about Lyme's Disease.

Deer habitat in Dockyard is generally high quality. Feeding habitat includes areas of cultivated shrubs and lawn, which provide more and higher quality food than would natural habitat; this was reflected in the good body condition of the animals and the high twinning rate. Security habitat (where deer go to avoid danger or disturbance) and thermal habitat (where deer go to avoid rain or cold winds or to obtain warmth from the sun) is also of high quality.

Human health and safety concerns appear to be minimal. The danger from collisions with motor vehicles appears to be minimal, given the low speed limit (30 - 50 km/h) on most of the base and the limited traffic after normal work hours and on weekends.

The number of deer present exceeds the social carrying capacity (i.e., the number of deer below which damage to landscaping is acceptable). It is also likely that the deer are adversely affecting the environment by reducing the number of plant species present, by preventing regeneration of some tree species, and by damaging nesting habitat for certain species of birds, although there is no clear proof of this in Dockyard. Should it be decided to reduce the population, the most acceptable option is probably contraception. Lethal removal and trap-and-transfer (which is attended by high mortality) may not be well accepted by the public.

Surveys for Terrestrial and Freshwater Molluscs on DND Lands near Victoria, Vancouver Island, British Columbia

Kristiina Ovaska and Lennart Soppuck

Biolinx Environmental Research Ltd., 1759 Colburne Place, Sidney, BC V8L 5A2
Tel: (250) 656-8981 • Email: Biolinx@shaw.ca

Summary

In the early spring and autumn of 2002, surveys were conducted to characterize the gastropod faunas of several habitats within the Heals Rifle Range, Mary Hill, and Rocky Point properties managed by the Department of National Defence, CFB Esquimalt. The emphasis was on species deemed to be rare or at risk.

The three DND properties surveyed harbour a rich and diverse terrestrial gastropod fauna. In total, 34 species, including 11 slugs (5 native, 6 exotic) and 23 snails (20 native and 3 exotic) were found. Species diversity was highest in habitats with a deciduous component, particularly in stands with big-leaf maple, aspen or alder, and in low-elevation coniferous forest. Garry oak woodlands contain a mixture of grassland and forest-dwelling gastropods, and exotic species of slugs and snails were strikingly abundant, especially at Mary Hill. Gastropod diversity was relatively low in higher elevation coniferous forests at Rocky Point and in wet meadow habitat at Heals Rifle Range. In freshwater habitats, surveyed in the autumn, nine species of molluscs including six snails, two sphaerid clams, and one limpet were recorded. One pond contained an exotic species of snail. Most species were found in "dug-out" ponds that still contained water despite a prolonged drought in the summer and autumn of 2002. Natural wetlands contained little or no water at the time of our surveys and could not be adequately sampled for freshwater molluscs.

During the surveys, two species of terrestrial gastropods that are rare and might be at risk were found: the Blue-gray Taildropper (slug) at Rocky Point and the Threaded Vertigo (snail) at Rocky Point and Heals Rifle Range. The Blue-gray Taildropper has not previously been reported from Canada and is a species of concern in the United States. Additional surveys are needed to obtain further information on the distribution and vulnerability of the species.

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CONTACT INFORMATION

MEMBERS

Don Beamish
Base Property Resource Officer
Base Construction Engineering Office
CFB Esquimalt, Bldg 575 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-4914
Fax: (250) 363-7980
beamish.dg@forces.gc.ca

Stephanie Blouin
Formation Natural Resources Officer
Formation Risk Management Branch
CFB Esquimalt, Bldg 199 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2313
Cell: (250) 213-3505
Fax: (250) 363-2567
blouin.sc@forces.gc.ca

Dr. Bill Dushenko
Royal Roads University
2005 Sooke Road
Victoria, BC V9B 5Y2
Tel: (250) 391-2580
Fax: (250) 391-2560
bill.dushenko@royalroads.ca

Andy MacKinnon
B.C. Ministry of Forests
Ecosystem Conservation
780 Blanchard St., Room 124
Victoria, BC V8V 1X4
Tel: (250) 387-8684
Cell: (250) 888-5799
Fax: (250) 953-3481
andy.mackinnon@gems1.gov.bc.ca

Ken Morgan
Canadian Wildlife Service
Environment Canada
c/o Dept. of Fisheries and Oceans
Institute of Ocean Sciences
P.O. Box 6000
Sidney, BC V8L 4B2
Tel: (250) 363-6537
Fax: (250) 363-6390
morgank@dfo-mpo.gc.ca

Dr. Richard Ring
University of Victoria, Biology Dept.
Room 254, Cunningham Building
P.O. Box 1700
Victoria, BC V8W 3N5
Tel: (250) 721-7102
Fax: (250) 721-7120
raring@uvic.ca

Dr. Tony Trofymow
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5
Tel: (250) 363-0600
Fax: (250) 363-0775
ttrofymow@pfc.cfs.nrcan.gc.ca

ALTERNATES

LCol Paul Arsenault
Base Construction Engineering Officer
CFB Esquimalt, Bldg 575 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2738
Fax: (250) 363-5784
arsenault.pa@forces.gc.ca

Dr. Doug Bright
Royal Roads University
2005 Sooke Road
Victoria, BC V9B 5Y2
Tel: (250) 391-2580
Fax: (250) 391-2522
doug.bright@royalroads.ca

Michael Dunn
Canadian Wildlife Service
Environment Canada
c/o Dept. of Fisheries and Oceans
Institute of Ocean Sciences
P.O. Box 6000
Sidney, BC V8L 4B2
Tel: (250) 363-6501
Fax: (250) 363-6390
michael.dunn@ec.gc.ca

Robert Faulkner
Manager – Corporate Realty Assets, DRFMS - 8
Directorate of Realty and Facilities Management Services
Major General Pearkes Building, NDHQ
101 Colonel By Drive, 9th Floor, CBN
Ottawa, ON K1A 0K2
Tel: (613) 996-5351
Fax: (613) 995-1031
faulkner.ra@forces.gc.ca

Duane Freeman
Acting / Formation Environment Officer
Formation Risk Management Branch
CFB Esquimalt, Bldg 199 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2644
Cell: (250) 480-9554
Fax: (250) 363-2567
freeman.de@forces.gc.ca

Dr. Brian Nyberg
Acting Manager, Integrated Resources Section
B.C. Ministry of Forests - Forest Practices Branch
P.O. Box 9513 Stn Prov Govt
Victoria, BC V8W 9C2
Tel: (250) 387-3144
Fax: (250) 387-1467
brian.nyberg@gems6.gov.bc.ca

John Parminter
Research Ecologist, Research Branch
B.C. Ministry of Forests
P.O. Box 9519 Stn Prov Govt
Victoria, BC V8W 9C2
Tel: (250) 356-6810
Fax: (250) 387-0046
John.Parminter@gems7.gov.bc.ca

Arthur Robinson
Pacific Forestry Centre - Canadian Forest Service
Natural Resources Canada
506 West Burnside Road
Victoria, BC V8Z 1M5
Tel: (250) 363-0729
Fax: (250) 363-0775
arobinson@pfc.cfs.nran.gc.ca

MWO Gordon Usipiuk
Range Control Officer - Base Operations
CFB Esquimalt
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 391-4162
Fax: (250) 391-4165
usipiuk.gm@forces.gc.ca

Dr. Neville Winchester
Department of Biology, University of Victoria
P.O. Box 3020
Victoria, BC V8W 3N5
Tel: (250) 721-7094
Fax: (250) 721-7120
tundrast@uvvm.uvic.ca

Bob Woods
Head, Rural Natural Resources (D Env P 5)
Directorate Environmental Protection
Director General Environment
Major General Pearkes Building, NDHQ
101 Colonel By Drive, 9th Floor, North Tower
Ottawa, ON K1A 0K2
Tel: (613) 995-4087
Fax: (613) 992-9422
woods.ra@forces.gc.ca

For more information, please contact:

National Defence / Défense nationale

CFB Esquimalt
Formation Risk Management Branch
Formation Environment Office
Bldg 199 Dockyard
P.O. Box 17000 Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2313 • Fax: (250) 363-2567
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